

EXPERIMENT STATION RECORD.

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¹ Printed in scientific and technical publications outside the Department.

EXPERIMENT STATION RECORD.

Vol. 38.

ABSTRACT NUMBER.

No. 9.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

Contribution to the chemistry of gossypol, the toxic principle of cotton seed, F. E. CARRUTH (*Jour. Amer. Chem. Soc.*, 40 (1918), No. 4, pp. 647-663).—Continuing the investigations previously noted (E. S. R., 38, p. 685), a special study was made of the chemical nature of gossypol.

Analyses of the purified substance prepared by several different methods which are given in detail show an empirical formula for gossypol of $C_{30}H_{24}O_4$ or $C_{30}H_{22}O_4$. It forms a crystalline compound with acetone, amorphous acetyl and benzoyl derivatives, and an insoluble substance with aniline. It readily forms salts with alkalis, and dissolves easily in sodium hydroxid and carbonate and very slowly in bicarbonate and disodium phosphate. Limewater and baryta water and ammonium hydroxid, both strong and dilute, do not dissolve it as readily as do alkali hydroxids. Alkaline solutions of gossypol oxidize readily on exposure to air or by adding hydrogen peroxid with the formation of a complex substance. Strong nitric acid dissolves gossypol with the formation of a substance no longer giving color reactions.

Three new substances which resemble gossypol more or less have been isolated. One called "B" gossypol is formed by heating gossypol in the air to its decomposition point. "C" gossypol is formed by fusing gossypol with alkalis to a fairly high temperature. "D" gossypol can be isolated from cottonseed meal and is thought to be the substance formed from gossypol in the cooking of cotton seed. The "B" and "C" forms are less poisonous than the original gossypol, but the "D" variety, although less toxic than the original gossypol, has been shown to give rise to cottonseed meal poisoning of rabbits and swine. If rather dry seed is used in the preparation of cottonseed meal, the gossypol is apparently not so readily converted into the less soluble, less toxic oxidation product but remains in part as such in the meal, causing such a meal to be more toxic than a properly cooked meal.

Attempts to get a clue to the constitution of gossypol have failed through inability to split the substance into simpler known substances.

The fact that several flavone pigments occur in the cotton plant and the fact that gossypol has 30 carbon atoms suggests that it may be derived by condensation and subsequent reduction of two molecules of a flavone. The acidic properties are thought to be due to carbonyl and hydroxyl groups arranged as in flavonols rather than to carboxyl groups. These substances are sufficiently acid to form salts from an alkali acetate. The presence of *o*-hydroxyl is indicated by the green ferric chlorid reaction and by the formation of lake-like compounds with lead and ferrous salts. The presence of 9 oxygen atoms

may be readily accounted for by the presence of 5 hydroxyls, 2 carbonyl groups and 2 bridge oxygen atoms, all of which types occur in the flavonols."

Corn stover silage, J. M. SHERMAN and S. I. BECHDEL (U. S. Dept. Agr., Jour. Agr. Research, 12 (1918), No. 9, pp. 589-600).—The authors at the Pennsylvania Experiment Station have tested the practicability of ensiling corn stover, and investigated the nature of the fermentation in the silage obtained. The stover used had been kept for several months and was quite dry at the time of cutting. It was cut and packed in the silo by means of tramping, water being added in a continuous stream. Samples of the silage were taken at frequent intervals and examined for general appearance, texture, and aroma. At the end of the experiment feeding tests were made. It was concluded that corn stover ensiled with a suitable quantity of water (from 2 to 2.5 parts by weight of water to 1 of stover) undergoes fermentation with the production of a palatable silage resembling ordinary corn silage in aroma and appearance and possessing good keeping quality.

In investigating the nature of the fermentation, determinations were made of the volatile and nonvolatile acids, temperatures, and numbers, and types of bacteria at various stages. The total acidity was somewhat lower than in ordinary silage, but the ratio between the volatile and nonvolatile acids agreed closely. A gradual decrease in volatile and an increase in nonvolatile acids were noted. The temperature changes were similar to those observed in ordinary silage. Bacteriological observations showed that the rather complex bacterial flora present at the beginning of the process gives way to one which is almost entirely acid-forming as the fermentation progresses.

In connection with a study of the nature of the fermentation, the authors review the present status of the question as to whether bacteria or plant cells are mainly responsible for silage fermentation (E. S. R., 35, p. 9; 36, pp. 611, 802; 37, pp. 208, 612). While their results tend to support the cell respiration theory, conclusions on this point are withheld. The fermentation taking place in stover silage is, however, believed to be similar in its essential points to that of ordinary silage and caused by similar factors.

The biochemical phenomena of oxido-reduction, [J.-E.] ABELOUS and [J.] ALOY (Compt. Rend. Acad. Sci. [Paris], 165 (1917), No. 7, pp. 270-272; also in Chem. Abs., 11 (1917), No. 21, pp. 2909, 2910).—In repeating the experiments of Bach on milk, previously noted (E. S. R., 26, p. 507), the authors have found that a large number of substances other than aldehydes act as odorants, among them the amines, heterocyclic compounds, terpenes, and mineral salts. On addition of an oxidizable substance simultaneous oxidation and reduction occurs. It would seem that there is present in milk an agent able to decompose water to furnish oxygen to the oxidizable and hydrogen to the reducible substances.

The necessity of a hydrogen acceptor and an oxygen acceptor for the manifestation of the processes of oxido-reduction in organic liquids of animal and vegetable origin, J.-E. ABELOUS and J. ALOY (Compt. Rend. Acad. Sci. [Paris], 166 (1918), No. 3, pp. 130-132).—Continuing the work noted above experiments on the oxidation of salicylic aldehyde* in milk and potato juice, with and without the addition of oxidizing substances like methylene blue or potassium chlorate, have shown the presence in milk of an agent capable of decomposing water in the presence of a hydrogen acceptor and an oxygen acceptor, both of which are indispensable. Although the nature of this agent is unknown it appears to act like a soluble ferment.

Studies on enzym action.—XV, Factors influencing the proteolytic activity of papain, E. M. FRANKEL (Jour. Biol. Chem., 31 (1917), No. 1, pp. 201-215, figs. 2).—The papain used in this work was purified by dissolving in water,

precipitating with acetone, redissolving in water, and reprecipitating with alcohol. The optimum action of papain was found to be at $\text{pH}=10^4$. Papain seems to act like urease, invertase, and lipase in forming an intermediary compound which is broken up into cleavage products and liberates the enzym. The quantitative relations of the enzym, hydrocyanic acid, and protein lend support to the view that there is a ternary compound formed which then breaks down. Hydrocyanic acid may be recovered almost quantitatively from digestion mixtures, indicating that it is not utilized in the reaction of fermentation but that it can renew proteolysis in papain digests that are almost in equilibrium.

Studies on enzym action.—XVI, The formation of ester-hydrolyzing substances by the action of alkali on proteins, FLORENCE HUTTON FRANKEL (*Jour. Biol. Chem.*, 32 (1917), No. 3, pp. 395-407; *abs. in Chem. Abs.*, 12 (1918), No. 3, p. 281).—The present investigation was undertaken to determine whether the activity of the ester-hydrolyzing substances follows the general laws of enzym action and to what extent they are specific in their action. The proteins used were casein, gelatin, and dried egg albumin. The esters used were of a high grade of purity and were in most cases redistilled after drying over sodium carbonate. The factors studied were the influence of concentration of alkali used and duration of action, of hydrogen ion concentration on the activity of alkali-treated proteins, of temperature of standing on the action of alkali on protein, the lipolytic activity of a papain digestion mixture of casein, and the effect of boiling on the lipolytically active substance.

It was found that proteins when treated with alkali yield substances which have the power to accelerate hydrolysis of esters. For casein, gelatin, and egg albumin, 3 N alkali seemed to produce solutions of the highest activity. These solutions showed greater activity at a concentration of the hydrogen ions less than 10^{-7} N. or they were more active in a slightly alkaline solution. The time and temperature at which the alkali stood in contact with the protein did not affect the activity of the solution except where the temperature was above 50°C . The solution obtained by hydrolyzing the protein by acid instead of alkali did not possess ester-hydrolyzing properties.

Polarimetry (U. S. Dept. Com., Bur. Standards Circ. 44 (1918), 2. ed., rev. and enl., pp. 196, pls. 2, figs. 13).—This is a revised and enlarged edition of the circular issued in 1914. It contains chapters on absolute measurement in circular degrees, saccharimeters, temperature corrections and control, polariscope tubes, cover glasses, flasks, thermometers, weights, optical activity in organic compounds, testing of raw sugar, polarimetric analysis of other sugars, estimation of reducing substances, the preparation of pure sugars, general instructions to applicants for tests, etc. In the appendixes 43 pages of additional data have been added comprising 10 tables, the results of recent polarimetric researches, a consideration of the polarization of low-grade products, a resumé of the work of the International Commission for Uniform Methods of Sugar Analysis, and amendments to the U. S. Treasury Department sugar regulations.

An improved automatic pipette-washing device, A. V. FULLER (*Jour. Indus. and Engin. Chem.*, 10 (1918), No. 4, p. 297, fig. 1).—This is a modification of the device previously noted (*E. S. R.*, 38, p. 203), the improvements being greater capacity, smaller table space occupied, lower first cost, and cleaning of both outside and inside pipettes.

A new method of extracting the soil solution, C. B. LIPMAN (*Univ. Cal. Pub. Agr. Sci.*, 3 (1918), No. 7, pp. 131-134; *abs. in Chem. Abs.*, 12 (1918), No. 10, p. 1094).—By means of a special form of pressure tube the author has succeeded in obtaining from soils the soil solution as it exists in thin films

around the soil particles. The method, which will be described in detail in a later paper, allows of the direct determination of the concentration of the soil solution and of the amounts of each of the solutes contained therein, and offers a means of obtaining quickly and directly large portions of the soil solution as it exists naturally under field conditions when crops are growing.

The valuation of lime for various purposes, R. K. MEADE (*Jour. Indus. and Engin. Chem.*, 10 (1918), No. 3, pp. 214-219, fig. 1).—This is a collection of material on the more important uses of lime in the arts, the classification of limes according to chemical composition, etc., the properties which lime should possess to be acceptable in each industry, and the methods most generally employed for the chemical analysis of lime.

Notes on the analysis of molasses, H. S. WALKER (*Jour. Indus. and Engin. Chem.*, 10 (1918), No. 3, pp. 198-202).—Experimental evidence indicates that in Clerget sucrose determinations in waste molasses the method of clarification with lead subacetate solution as recommended by the Hawaiian Chemists' Association yields results from 0.5 to 0.7 per cent too high, due to the large volume occupied by the lead precipitate. Clarification with dry lead subacetate is apt to run a little low, especially if an excess of lead is used. A modification of the dry lead method which gives more correct results is described.

A comparison of the proximate and mineral analysis of desiccated skim milk with normal cows' milk, E. P. HARDING and H. RINGSTROM (*Jour. Indus. and Engin. Chem.*, 10 (1918), No. 4, pp. 295-297).—Proximate and mineral analyses are reported of four different samples of commercial desiccated skim milk and the results compared with previous analyses of skim milk powders and with normal cows' milk. The color, odor, and emulsifying power of the samples were noted.

The data show that the percentages of the mineral constituents in the four samples agreed quite closely, but did not agree well with those found by other analyses. The sulphuric acid, calcium and magnesium oxides, and phosphoric anhydride were higher and the ferric oxide lower than in other methods. The high phosphorus and calcium content may be due to phosphate and calcium added as emulsifiers.

The proximate analyses agreed quite closely with previous analyses. The color, odor, emulsifying power, high protein, low lactose, high calcium and phosphorus content, and low total proximate analysis of one of the samples indicated that it was not genuine desiccated skim milk powder.

Tentative standard methods for the sampling and analysis of commercial fats and oils (*Jour. Indus. and Engin. Chem.*, 10 (1918), No. 4, pp. 315-320, fig. 1).—To the methods previously noted (*E. S. R.*, 38, p. 206) have been added methods for the determination of the iodine value according to the Wijs method and the saponification or Koettstorfer number.

The determination of arsenic in insecticides by potassium iodate, G. S. JAMIESON (*Jour. Indus. and Engin. Chem.*, 10 (1918), No. 4, pp. 290-292).—The author has applied the iodate titration method as first described by Andrews (*E. S. R.*, 15, p. 226) to the determination of total arsenic in arsenical insecticides or fungicides, and compared the results with those obtained by the official iodimetric method (*E. S. R.*, 35, p. 207). The method is described in detail and data reported of the determination of arsenic in several samples of Paris green and zinc arsenite.

The results of the test analyses agree closely with those obtained by the official method. "This accurate method is not only quicker, but is simpler than the iodine titration. The very definite and remarkably sharp end-point, the great stability of the potassium iodate solution, and the readiness with

which it can be prepared all recommend its use in place of the iodimetric procedure."

An optical method for the determination of malic and tartaric acids in the same solutions. J. J. WILLAMAN (*Jour. Amer. Chem. Soc.*, 40 (1918), No. pp. 693-704, fig. 1).—The method described is based upon the use of a given set of conditions in constructing tables or curves with known amounts of pure malic and tartaric acids, which curves can then be used for the determination of unknown quantities of these acids. The combination of conditions to give satisfactory results from the standpoints of accuracy, ease of manipulation, and applicability to materials from varied sources was determined after a study of the effect of various factors on the rotating power of solutions of malic and tartaric acids. The method adopted is as follows:

An amount of the sample that will probably furnish at least 0.1 gm. of either acid and not more than 0.6 gm. of tartaric acid and 0.8 gm. of malic acid is neutralized with approximately normal ammonium hydroxide, treated with 2 volumes of 95 per cent alcohol, and the pectins filtered off on a Büchner funnel and washed with alcohol. To the filtrate is added an excess of a 10 per cent barium acetate solution in 50 per cent alcohol and enough 95 per cent alcohol to make 14 volumes to 1 of the original solution. The precipitated barium salts are removed by centrifuging or by filtering on a Büchner filter. The precipitate is transferred to a beaker with hot water, heated to boiling, 30 cc. of 20 per cent ammonium sulphate solution added, and the mixture concentrated on the steam bath to about 80 cc. volume and transferred to a 100 cc. flask. After cooling, 6 cc. of glacial acetic acid is added and the contents made up to the mark with water. It is then filtered or centrifuged and two 25 cc. aliquots of the clear solution are treated, respectively, with 10 cc. of 8 per cent cerium acetate solution, and 10 cc. of 10 per cent ammonium molybdate solution. After standing in the dark for three hours, the solutions are polarized in a 2 dm. tube at about 20° C. The two readings are then referred to the graph and the amounts of malic and tartaric acids computed.

As some of the reagents and conditions may be difficult to duplicate in some laboratories the author recommends that each worker adopt conditions and reagents as near as possible to those listed and then standardize his procedure against known amounts of malic and tartaric acids. The factors likely to be subject to change in different laboratories and which can be safely changed, provided they are incorporated in the above standardization, are the kind of light used with the polariscope, the length of time of standing before polarization, the temperature at which the polarization is made, and the purity of the cerium and molybdenum salts used as activators.

The method is said to be applicable for all products containing *D*-tartaric or *L*-malic acid, or both. Highly colored solutions can be worked with only after decolorizing with bromin and neutralizing the hydrobromic acid formed with ammonia.

The deterioration of raw cane sugar: A problem in food conservation. C. A. BROWNE (*Jour. Indus. and Engin. Chem.*, 10 (1918), No. 3, pp. 178-190, fig. 15).—The results of chemical and mycological investigations on the deterioration of raw cane sugar are reported.

Periodic analyses of sugars showed that the so-called factor of safety, $\frac{W}{100-S}$, where W is the percentage of water and S the percentage of sugar, should be about 0.3. If sugars are to be kept where the temperature maximum exceeds 20° C., only such sugars should be selected as have a factor of safety below 0.3. Where sugars of low factor deteriorate, the explanation may be

that the sugar is losing moisture and that the loss in polarization from destruction of sucrose is counterbalanced by the drying out of the product, or that there is uneven distribution of moisture with consequent fermentation where the films of molasses adhering to the sucrose are more dilute. The following corollaries to the ratio between moisture and nonsucrose as the governing factor in the keeping quality of raw cane sugar should be considered: (1) Slight fluctuations in moisture content have a much greater influence upon the keeping quality of high-grade than of low-grade sugars, (2) displacement or saturation of moisture by nonsucrose constituents should render a questionable sugar fit for storage, and (3) sugars which are prevented from absorbing moisture, as in a sealed container, can deteriorate only to a certain limit.

Mycological investigations with raw Cuban sugar showed the presence of a relatively harmless noninverting *Torula*, named by the author *T. communis*; two destructive varieties of *Monilia*, *M. nigra* and *M. fusca*; a liquefying inverting organism to which the name *Bacterium invertens* was given; and other organisms, including molds. The conclusions emphasized by the author are "that the microorganisms of raw cane sugars, as regards their action upon sucrose, are in part harmless and in part destructive; that the destruction of sucrose in deteriorated sugar is not due to any single organism or class of organisms; molds and budding fungi, as well as bacteria, must be looked for when searching for the agents of destruction; and that the fungi and bacteria which cause the inversion of sucrose in raw sugars, are unable to thrive in saturated solutions. The washing of raw sugars in the centrifugals, by diluting the saturated films of sirup to a point where the inverting organisms can thrive, must therefore be regarded as a leading cause of deterioration."

As a means of prevention of the deterioration of raw cane sugars the author suggests that "in the matter of manufacture it is necessary to exercise the utmost possible cleanliness and care in order to diminish infection, to control the moisture content of the sugar so that the ratio of nonsucrose to water is within the limits of safety, and to cool the sugar thoroughly before bagging to prevent the migration of water and the formation of zones of high moisture content. In the matter of storage it is necessary to keep the sugar perfectly dry in warehouses which are rain-proof, to keep the warehouse tightly closed in wet weather to prevent the sugar absorbing moisture from the air, and to construct the warehouse and store the sugar so as to secure in dry weather the maximum ventilation underneath and between the bags."

General instructions regarding the manufacture of fruit wines, J. DE RANZ (Instrucciones Generales sobre la Fabricacion del Vino de Frutas. Mexico City: Dir. Gen. Agr., 1917, pp. 34, figs. 9).—This publication includes general methods for the manufacture of fruit wines and cider, and special directions and recipes for sparkling cider, pear cider, and cherry, currant, mulberry, pomegranate, orange, honey, and quince wines.

Beechnut oil, an indigenous edible oil to manufacture in time of war. A. TRUELLE (Vic Agr. et Rurale, 7 (1917), No. 38, pp. 209, 210).—This article gives a summary of the different phases of the manufacture of beechnut oil and of the properties and uses of the oil and its by-products with a view toward its greater utilization as an edible oil and in soap making. The analytical constants of the oil are given, together with the analysis of the decorticated and undecorticated oil cake. The undecorticated cake is poisonous, but the decorticated can be used to advantage in animal feeding. The purified oil has an agreeable taste resembling that of hazelnuts and can be used as a table oil alone or mixed with olive oil.

Influence of time of harvest, drying, and freezing of spearmint upon the yield and odorous constituents of the oil. F. RABAK (*Jour. Indus. and Engin. Chem.*, 10 (1918), No. 4, pp. 275-279).—Investigations of spearmint oil having indicated that esters or alcoholic compounds play an important part as carriers of the aroma and flavor, a study of the plant was undertaken at Arlington Farm, Va., to obtain information regarding the effect of time of harvest, drying of the plant, and frost action upon the constituents as well as upon the yield and physical properties of the oils. The plants were harvested and distilled at three different stages of growth, viz. budding, flowering, and fruiting.

It was found that the yield of oil is affected by seasonal conditions, being distinctly higher in some seasons than in others. The maximum content of oil is present during the flowering period, the tops containing the largest amount of oil. Esterification and alcohol formation tend to increase, and yield of total oil to decrease, during the maturing and drying of the plants. Freezing of the plant produces a marked increase in the formation of the odor-bearing esters and alcohols.

A preliminary study of the Philippine coconut oil industry. P. A. VILLYAR (*Philippine Agr. and Forester*, 6 (1917), No. 2-3, pp. 66-83, figs. 10).—A study of the factory conditions in some oil-producing localities in the Province of Laguna is reported. The article includes a description of the native hand-press and machine-press methods with illustrative plates, and an efficiency study of 11 native factories based on field investigation of methods practiced and appliances used, on laboratory analyses of samples obtained in the field investigation, and on a comparison of the native methods of coconut oil extraction with the modern methods.

As a result of the study the author offers the following suggestions for the improvement of the coconut oil industry:

"Cooperation is urged as a remedy against the loss of money due to poor cultural methods, to the improper preparation and handling of coconut products, and to the combined work of the middlemen. Adoption of modern methods is essential to increase the copra and oil production. Nuts for copra and oil manufacture must be properly aged to insure a maximum yield. The passing of laws facilitating the transportation of coconut products should be demanded from the proper authorities."

The manufacture of nut margarin. G. H. PICKARD (*Amer. Food Jour.*, 13 (1918), No. 1, pp. 16-19).—This article includes a description of the raw materials used and the general processes of manufacture of nut margarin, with a discussion of its digestibility and food value.

The utilization of waste tomato seeds and skins. F. RABAK (*U. S. Dept. Agr. Bul.* 632 (1917), pp. 15).—This includes a review of work already done in foreign countries on the utilization of tomato waste, an investigation of the annual output of tomato refuse in the United States, a comparison of methods of separating the ingredients of the waste, and chemical analyses and value of the most important ingredients.

It is estimated that the annual dry waste from the tomato industries in the United States is about 1,500 tons of seeds and 1,800 tons of skins. From the seeds can be extracted an oil averaging by the continuous extraction process 22 per cent of the dry seeds.

The refined oil is similar in constants to cottonseed, soy-bean, sesame, and corn oils. Digestibility experiments by the Office of Home Economics show a coefficient of digestibility of 97, comparing favorably with the common edible oils. It possesses a certain value as a paint or varnish oil and makes a soap of good texture. The residue after extraction of the oil compares favorably

with other seed meals used for stock feed, analysis showing moisture 7.15, ash 4.64, protein 37, nitrogen-free extract 29.1, and fiber 22.11 per cent. By incorporating the dried skins with the meal, the annual amount available as feed stuff would be about 3,000 tons.

The accumulation of tomato residue occurs principally in the North Central and North Atlantic States. The author of the bulletin suggests that the reduction of waste material to oil and meal could best be handled by establishing a reducing plant at some central point in each of these sections. In view of the threatened shortage of fatty oils, it is suggested as an economic measure of both agricultural and industrial importance that the utilization of this material be considered.

The utilization of waste tomato seeds and skins, F. RABAK (*Chem. News* 117 (1918), No. 3040, pp. 100-104).—A condensation of the above article.

The effect of incomplete distillation on the yield of products in the destructive distillation of birch, R. C. PALMER (*Jour. Indus. and Engin. Chem.* 10 (1918), No. 4, pp. 260-262).—Semicommercial laboratory distillations were made with birch in which the distillation was stopped before completion and the brands obtained redistilled.

The results showed that the combined effect of the distillation in two steps gave practically the same yields of valuable products as when the distillation was completed in one step. The order in which the products were formed in the destructive distillation process is formic acid, acetic acid, tar soluble in pyroligneous acid, wood alcohol, and oily tar.

The influence of moisture on the yield of products in the destructive distillation of hardwood, R. C. PALMER and H. CLOUKEY (*Jour. Indus. and Engin. Chem.*, 10 (1918), No. 4, pp. 262-264).—Uncontrolled and controlled destructive distillations were made with beech, birch, and maple, one lot of which had been seasoned for about 18 months and the other for about 8 months. In uncontrolled distillation the maximum fire was kept under the retort until the tar point was well established, and the fire was then checked so that the distillation was completed largely by means of the exothermic reaction. In the controlled distillation the fire was checked at the first indications of tar in the distillate and the firing so regulated that after that point the rate of rise in temperature was appreciably lower than in uncontrolled distillations. The effects of moisture and control on the yields of the various products were as follows:

The highest yields of acetic acid from beech and maple were obtained with carefully controlled distillations after moderate seasoning; with birch the amount of seasoning did not seem to affect the total yield. The highest yields of formic acid were obtained from rapid uncontrolled distillation, particularly in the case of beech. Excess of moisture gave higher yields of alcohol in the case of beech, and in uncontrolled distillation, of maple. The drier wood gave more alcohol in the case of birch, and in controlled distillation, of maple. Excess of moisture gave a lower yield of tar in maple and birch and of charcoal in maple and beech.

The effect of catalyzers on the yield of products in the destructive distillation of hardwoods, R. C. PALMER (*Jour. Indus. and Engin. Chem.*, 10 (1918), No. 4, pp. 264-268).—Preliminary laboratory experiments were made for the purpose of studying the influence of hydrolytic catalyzers on the formation of wood alcohol, acetic acid, etc., (1) during the primary reaction occurring in the destructive distillation of wood and (2) during any secondary reactions that take place between the original products. Experiments were also made on the distillation of wood in the presence of wood tar in a study of the possibility of splitting off methyl groups from the tar to form methyl alcohol. Maple and

wood chips were used which had been soaked in phosphoric acid as a catalyzer. Analyses were made of the moisture content of the charge; weight of distillate and charcoal; and percentage of total, acetic, and formic acids, settled and soluble tar, wood alcohol, and acetone in the distillate. The conclusions drawn from the preliminary tests are as follows:

“(1) Under the proper conditions a very high yield of acetic acid may be obtained by the destructive distillation of wood, by using phosphoric acid as a catalyzer. Two and seven-tenths times as much acid as normal was obtained in one run. (2) The distillation of wood in the presence of phosphoric acid showed a pronounced tendency to give more wood alcohol. Increases varying from 40 to 90 per cent were obtained. (3) The distillation of mixtures of wood and tar under pressure showed that the methoxy groups in the tar can be readily split off, forming wood alcohol. Nearly 20 per cent of a possible theoretical was obtained at 90 lbs. pressure.”

A study is being made of the possibility of recovering the metaphosphoric acid residual in the charcoal, thus making practicable the use of phosphoric acid as a catalyzer.

Effect of varying certain cooking conditions in the production of sulphite pulp from spruce, S. E. LUNAK (*U. S. Dept. Agr. Bul. 620 (1918), pp. 23, pls. 12, figs. 10*).—In the experiments recorded in this publication the following factors involved in the sulphite process for wood pulp were studied for the effect of variations in them on duration of cooking, yield of pulp and of screenings, bleach consumed, and color and strength of pulp produced: (1) Ratio of free to combined sulphur dioxide, or the amount of lime in the cooking liquor; (2) total sulphur dioxide; and (3) temperature of cooking.

The wood used in the experiment was Wisconsin white spruce (*Picea canadensis*), cut into $\frac{1}{2}$ -in. chips and screened in the usual way. In order to control the various factors the digester was heated by indirect steam. The best method to judge when the digestion was finished proved to be a color test in which the standard was a previously prepared extract of coffee of the desired shade. The methods of analysis are described in detail and a diagram given of the apparatus used.

The experimental data show that at constant temperature and total SO_2 , an increase in the combined SO_2 causes an increase in the yield of screened pulp owing to the more thorough cooking, while a decrease in the combined SO_2 causes quicker cooking action. The limit to which the combined SO_2 can be increased to obtain good cooking seems to be about 1 per cent, below which there is a rapid darkening of the pulp produced, and an increase in the screenings and bleach consumed.

An increase in the total SO_2 causes a decrease in the cooking period and greater ease in bleaching the pulp. The screenings and color of the pulp remain constant, as the total SO_2 is decreased to about 5 per cent, after which there is a rapid increase in both factors.

A decrease in temperature causes more even cooking, with consequent reduction in the amount of screenings and bleach and increase in the yield of pulp.

Some experiments on the pulping of extracted yellow pine chips by the sulphate process, O. KRESS and C. K. TEXTOR (*Jour. Indus. and Engin. Chem.*, 19 (1918), No. 4, pp. 268-270; *abs. in Chem. Abs.*, 12 (1918), No. 10, pp. 1122, 1123).—Experiments were conducted to determine whether longleaf pine chips, after the extraction of rosin and turpentine, would be suitable for the manufacture of kraft paper.

The results show that a commercial grade of kraft pulp might be made from the chips, but it is evident “that the best results will be obtained if the chips

are carefully selected by means of a proper screening system, by using the largest chip for extraction compatible with maximum recovery of the oils and rosin, and by avoiding, as far as possible, the burning of the chips in the preliminary steaming for removal of turpentine and rosin."

Sulphite turpentine, A. W. SCHORGER (*Jour. Indus. and Engin. Chem.*, 1918, No. 4, pp. 258-260).—Attention is called to the sulphite turpentine obtained during the recovery of the sulphur dioxide in the manufacture of paper by the sulphite process and to its possible value as a source of toluene and cymene from which carvacrol can be prepared. The recovery of this oil from 0.36 to 1 gal. of turpentine per ton of pulp. Methods for identifying cymene and for preparing carvacrol from cymene are described.

Van Nostrand's chemical annual, edited by J. C. OLSEN (*New York: D. Van Nostrand Co., 1918, 4. ed., rev. and enl., pp. XVIII+778, pl. 1*).—In the preparation of the fourth issue of this annual a very thorough revision of all tables has been made and about 48 new tables have been added. The section on stoichiometry has been revised and explanations of the use of various tables have been inserted throughout the volume.

Charles Anthony Goessmann (*Cambridge, Mass.: Corporation and Associates Alumni Mass. Agr. Col., 1917, pp. [VII]+187, pls. 11; rev. in Jour. Amer. Chem. Soc., 40 (1918), No. 3, pp. 578-582*).—Dr. Goessmann was associated with the Massachusetts Agricultural College for nearly 40 years as professor of chemistry and first director and chemist of the station (*E. S. R.*, 18, p. 1101; 23, p. 401). The book is not only a personal biography but a historical record of the chemical and agricultural investigations conducted at the college and station during the period of his service there from 1868 to 1907. The book contains also letters from Frederick Wöhler and an appendix consisting of a list of the published writings of Dr. Goessmann and a chronology of his life.

METEOROLOGY.

Suggestions in regard to extending the area of spring wheat culture (*U. S. Dept. Agr., Nat. Weather and Crop Bul., No. 1 (1918), p. 3*).—Briefly reviewing a paper dealing with the northern and southern limits and optimum conditions for spring-wheat culture in the United States "it is shown by means of computing table and maps that there is a considerable area where the climatic conditions appear to be favorable for spring wheat, but in which it has not been tried at all or only in a small way. If it is possible to grow it, even as a catch crop, when winter wheat has been winterkilled and when small quantities are needed for local consumption it would contribute to increased supplies. Such areas include certain sections of Pennsylvania, West Virginia, western Virginia and western Maryland when tillable land occurs above certain altitudes, above 600 ft. in northern to above 1,800 ft. in southern Pennsylvania, above 1,800 ft. in northern to above 3,000 ft. in central West Virginia, above 1,800 ft. in western Maryland, and above 2,000 to 3,000 ft. in the mountains north of the 38th parallel of latitude in Virginia. . . . The time to sow, in an average season, will be between about the last of March to May 5, the earlier dates at the lower and the later at the higher latitudes and levels in the States mentioned."

"In addition to these higher altitudes where the conditions should be most favorable for the growth of spring wheat as a catch crop or to increase the area over that devoted to winter wheat, there is a far more extensive area similar in climate to that of northern Illinois and eastern Iowa, Nebraska, and Kansas where the reports show that spring wheat is sometimes grown as a regular catch crop. Such areas are found in northern and central Indiana and Ohio."

western Pennsylvania, West Virginia, and Virginia between about 800 and 2,000 ft. elevation, and in North Carolina, northwestern corner of Georgia, eastern Tennessee, and Kentucky above about 1,400 ft. elevations. It would seem that experiments with early varieties, such as Marquis, which have been found best adapted to the more southern range in which they have been tried should be undertaken on a small scale in all of these areas. The dates for sowing in the lower area as well as those for the higher levels mentioned will agree closely with those which have been found best for spring oats, and the time it will be ready for harvest will also agree quite closely with that of oats. In the upper area mentioned the time of seeding would be from as early as it is possible to sow in March to the 10th of April, with harvest from the middle of July to the 10th of August."

Nitrites from nitrates by sunlight. R. Moore (*Obs. in Nature* [London], 100 (1917), No. 2513, p. 338; *U. S. Mo. Weather Rev.*, 45 (1917), No. 12, pp. 602, 603).—"Dilute solutions of nitrates exposed either to sunlight or to a source of light rich in light-energy of short wave-length (such as light from a mercury vapor arc inclosed in silica) undergo conversion of nitrate into nitrite. There is an uptake of chemical energy in this reaction transformed from light energy, as in the formation of organic carbon compounds in foliage leaves; it is to be added to the relatively small number of endothermic reactions induced by light. When green leaves are immersed in nitrate solution comparatively little nitrite accumulates, indicating that nitrites are rapidly absorbed by the green leaf. Nitrates taken up by plants from soil would, in presence of sunlight, be changed to nitrites; which are much more reactive than nitrates. This indicates that the early stages of synthesis of nitrogenous compounds are carried out in the green leaf and aided by sunlight. Rain water collected for a considerable time contains no nitrites, all having been oxidized to nitrates; but if exposed to bright sunlight or ultra-violet light for a few hours a strong reaction to nitrites is always obtained. There is no hydrogen peroxid or ozone in air at surface level."

Monthly Weather Review (*U. S. Mo. Weather Rev.*, 45 (1917), Nos. 11, pp. 26-72, pls. 9, figs. 12; 12, pp. 573-636, pls. 13, figs. 5). In addition to weather forecasts, river and flood observations, and seismological reports for November and December, 1917; lists of additions to the Weather Bureau Library and of recent papers on meteorology and seismology; notes on the weather of the months; solar and sky radiation measurements at Washington, D. C., during November and December, 1917; condensed climatological summaries; and the usual climatological tables and charts, these numbers contain the following articles:

No. 11.—Observations of the Neutral Points of Atmospheric Polarization from Great Heights, by A. Wigand (reprinted abs.); Some Nuclei of Cloudy Condensation, III, by J. Aitken (reprinted abs.); Relation between Sunlight and Twilight, by J. S. Dow (reprinted abs.); Minute Structure of the Solar Atmosphere, by G. E. Hale and F. Ellerman (reprinted abs.); Why the Axes of the Planets are Inclined (illus.) by W. H. Pickering (reprinted); Shall We Revise Our Nomenclature for Thermometric Scales? by C. F. Marvin; Some Researches on the Far Eastern Seasonal Correlations.—Fourth Note (illus.), by T. Okada (abs.); Sun Spots, Magnetic Storms, and Rainfall (illus.), by H. Aretowski; Local Wind of the Foehn Type near San Francisco Bay (illus.), by B. M. Farney; Nebraska Hailstorm of August 8, 1917 (illus.), by G. A. Loveland; Vapor Pressure of Ice, by S. Weber (reprinted abs.); The Arithmetic Mean and the "Middle" Value of Certain Meteorological Observations, by L. Becker (reprinted abs.); and New Zealand Standard Time (reprinted).

No. 12.—Lunar Total Eclipse, 1917, July 4, by L. Picard (reprinted abs.); Lunar Total Eclipse of December 27-28, 1917, at Honolulu, by C. A. Reichert; Permanent Periodicity of Sun Spots, by J. Larmor and N. Yamaga (reprinted abs.); Polarization of Skylight, by A. Gockel (abs.); Solar Corona: Five Year Recent Observations, by J. Maurer (abs.); Need of Geophysical Observing Stations, by P. Gruner (abs.); West Indies Hurricanes as Observed in Jamaica (illus.), by M. Hall; The Settlement of Tropical Australia (illus.), by G. Taylor (reprinted); Practical Hint in Forecasting Minimum Temperatures, by W. G. Reed; Meteorology and War-Flying, by R. DeC. Ward; Waterspouts Near Tatoosh Island, Wash., by R. C. Mize; Meteorology of Greenland's Inland Ice and Its Foehn, by A. de Quervain (abs.); Variations of Alpine Glaciers, by P. L. Mercanton (reprinted abs.); Aqueous Exchange between the Nève and the Atmosphere, by R. Billwiller (abs.); Use of Monthly Mean Values in Climatological Analysis, by E. G. Bilham (reprinted abs.); Bathyrhæometer as Anemometer, by Y. Delage (abs.); Nitrites from Nitrates by Sunlight, by R. Moore (reprinted abs.) (see p. 811); Centennial of Meteorological Station at the Grand Saint-Bernard, by R. Gautier (abs.); Time Zones at Sea (reprinted abs.); Baron Dairoku Kikuchi, 1835-1917, by T. C. Mendenhall; Rollin Arthur Harris, Ph. D., 1863-1918; and Recent Distinctions in Meteorology.

Meteorological observations at the Massachusetts Agricultural Experiment Station, J. E. OSTRANDER and A. L. CHANDLER (*Massachusetts Sta. Met. Bu. 349-350 (1918), pp. 4 each*).—Summaries of observations at Amherst, Mass., on pressure, temperature, humidity, precipitation, wind, sunshine, cloudiness, and casual phenomena during January and February, 1918, are presented. The data are briefly discussed in general notes on the weather of each month.

SOILS—FERTILIZERS.

Soil survey of Hempstead County, Ark., A. E. TAYLOR and W. B. COX (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1916, pp. 53, fig. 1, map 1*).—This survey deals with the soils of an area of 465,280 acres in southwestern Arkansas lying entirely within the Coastal Plain province. The topography is generally undulating to gently rolling, the area being well drained, although there are rather extensive level, poorly drained sections consisting of broad flood plains and river terraces.

About 75 per cent of the soil material of the county is residual in origin, the remainder being of alluvial origin. Thirty-three soil types of twenty series are mapped. Ruston fine sandy loam and Ruston very fine sandy loam predominate, occupying 15.8 and 12.1 per cent of the total area, respectively.

Soil survey of Fillmore County, Nebr., A. H. MEYER, C. E. COLLETT, and N. A. BENGTSON (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1916, pp. 24, pl. 1, fig. 1, map 1*).—This survey, made in cooperation with the State of Nebraska, deals with the soils of an area of 368,640 acres in the southeastern part of the State lying entirely within the loess-covered portion of the Great Plains province. The topography of the county ranges from almost flat to slightly undulating, with a small area of terrace and bottom land along the streams. The region as a whole is well drained.

The soils of the county are derived from loess material, glacial drift, and alluvial and lacustrine deposits. Seven soil types of six series are mapped. Grundy silt loam occupying 87.4 per cent of the total area.

Water extractions of soils as criteria of their crop-producing power, J. S. BURD (*U. S. Dept. Agr., Jour. Agr. Research, 12 (1918), No. 6, pp. 297-309, fig. 1*).—On the basis of investigations at the California Experiment Station on extractable substances (nitrate, phosphate, and basic ions—K, Ca, and Mg) in

cropped and uncropped soil, here reported, the author concludes that the evidence obtained from a strictly chemical examination of the water extracts of soils is sufficient "to justify the hope that we may be able to predict, within reasonable limits, the relative crop-producing powers of soils by comparing their figures presenting these characters with similar data derived from soils whose productive power is known. Before such a method is generally applicable, however, it will be necessary to study the behavior of many soils with numerous types of crops."

Effect of season and crop growth in modifying the soil extract, G. R. NEWART (U. S. Dept. Agr., Jour. Agr. Research, 12 (1918), No. 6, pp. 311-368, figs. 24).—In the investigations at the California Experiment Station here reported in detail "the water-soluble nutrients in 13 soils of 2 different types were periodically determined during two seasons. Throughout the second season comparisons were made between the planted soil and its uncropped duplicate. Notable differences were observed between the nitrates, calcium, potassium, and magnesium present in the water extracts from the cropped and uncropped soils. The phosphates did not exhibit corresponding differences. Great dissimilarities were observed in the phosphate content of different soils, and in any one soil the amount was practically constant in both the cropped and uncropped plot. Striking differences occurred between the soluble nutrients present in the various uncropped soils. While the crops were growing the concentrations of nutrients in 8 of the 13 planted soils were practically the same. These eight included both good and poor soils. The three poorest soils yielded the smallest amounts of water-soluble nutrients and the smallest differences between the cropped and uncropped duplicates. The comparisons between the planted and unplanted duplicates furnished valuable indexes of the inherent capacities of the soils to produce nutrients. . . .

"The amounts of the water-soluble nutrients obtained by varying the ratio of soil to water were studied. The relationship of the compounds extracted did not change essentially in the lower concentrations. By comparison with freezing-point determinations the concentration of the soil solution calculated from the water extract was shown to be from two to four or five times as great as the actual soil solution.

"Variations in the water extract were correlated with variations in the freezing points of the same samples of soil. From the results of the freezing-point determinations it is concluded that variations in the water extract reflect actual changes in the soil solution. The results of the investigation show that large amounts of water-soluble nutrients are developed by cultivation, plowing, and biennial cropping, and demonstrate the soundness of these practices."

A list of 63 references to literature cited is given.

The freezing-point method as an index of variations in the soil solution due to season and crop growth, D. R. HOAGLAND (U. S. Dept. Agr., Jour. Agr. Research, 12 (1918), No. 6, pp. 369-395, figs. 9).—In the investigations at the California Experiment Station here reported freezing-point depressions were determined on 13 soils under a variety of conditions. The concentration of the soil solution was "found to vary with the season and also as a result of treatment with carbon dioxide, leaching, incubation, etc. The growth of a crop markedly diminished the concentration of the soil solution. This effect was still evident at the beginning of the following season. The soil solutions under conditions favorable to crop growth were found to be very dilute, particularly at the height of the growing season. Certain general agreements between the extraction and freezing-point methods are discussed."

Nine references to literature bearing on the subject are cited.

Humus in mulched basins, relation of humus content to orange production, and effect of mulches on orange production, C. A. JENSEN (U. S. Dept. Agr., *Jour. Agr. Research*, 12 (1918), No. 8, pp. 505-518).—This is a report of a study made at Riverside, Cal., on (1) the changes in the humus content of soils in basins mulched with different organic substances, (2) the effect of lime on the humus content of the soils, and (3) the relation of the humus content of the soil to fruit production. "Humus" was determined colorimetrically in the extract obtained by boiling the soil, which had previously been freed from lime by extraction with 1 per cent hydrochloric acid, in 7.5 per cent sodium-hydrate solution for 2 minutes. The "basins" referred to were areas in the citrus grove inclosed in earth embankments for purposes of irrigation. The materials used as mulches included alfalfa, sweet clover, bur clover, bean straw, barley hay, pine shavings, and cow manure. The mulches were used with and without the addition of lime, and in one experiment dried blood, tankage, phosphate, bone meal, and sulphur were used in addition to alfalfa and manure mulches.

The percentage of humus in the soil of the mulched basins varied from time to time. With manure and alfalfa mulches it increased more rapidly in clay-loam soils than in lighter soils. As a rule, the increase was greater with manure than with alfalfa. The addition of lime to the manure did not increase the humus, but in most cases there was an increase of humus when lime was used with the alfalfa mulch. Blood, tankage, acid phosphate, bone meal, or sulphur did not appreciably affect the humus content. There was no evidence of appreciable accumulation of humus in the lower depths of the soil as a result of leaching; there was no evident correlation between the humus content of the soil in the mulched basins and the amount of fruit produced; and there was no evident effect of lime on orange production. "Alfalfa and bean-straw mulch in basins on the heavier soil types produced from 30 to 100 per cent more oranges per tree than manure mulch. Manure mulch produced more oranges per tree than either barley hay, sweet clover, bur clover, or pine shavings. These differences were obtained in the summer following the application of the mulches in the preceding fall." Apparently alfalfa and manure mulches had no effect on fruit production of lemons during the first year on lighter soils.

In all experiments so far conducted the mulched-basin system has produced favorable growth response in a few months on the heavier soil types, a longer time being required to produce appreciable response on the lighter soil types.

"It would appear directly from the work here reported, and indirectly from work elsewhere reported, that the degradation products from freshly decomposing organic substances are more effective in orange production than the amount of 'humus' formed. And the value of a given mulch does not necessarily depend upon its being a legume or nonlegume."

The relation of weed growth to nitric nitrogen accumulation in the soil. L. E. CALL and M. C. SEWELL (*Jour. Amer. Soc. Agron.*, 10 (1918), No. 1, pp. 35-44; *abs. in Chem. Abs.*, 12 (1918), No. 5, p. 511).—This paper reviews the results of experimental work conducted at the Kansas Experiment Station. In an effort to show that "in the past too much emphasis has been placed on tillage as an agent directly contributing to the formation of nitrates through its effect on [the incorporation of organic matter, the distribution of bacterial flora, aeration, and moisture], and too little emphasis on it as an indirect means of assisting in the accumulation of nitrates by preventing weeds from using them in their growth."

Briefly reviewing previous investigations by the senior author (E. S. R., p. 217), additional experimental work is described in which the nitrates in the soil were determined on plats left uncultivated and weeds allowed to grow, cultivated 3 in. deep, cultivated 6 in. deep, and left uncultivated but the weeds

removed. The average annual development of nitrates for the period of 1914 to 1916, inclusive, amounted to 81.6, 413.3, 481, and 556.3 lbs. per acre, respectively. In 1916 and 1917 the quantity of nitrogen contained in the weeds on the weed plats was determined, calculated as nitrates, and when added to the nitrates present in the soil of the weed plats amounted to 474.3 lbs. of nitrate per acre in 1916 and 358.8 lbs. in 1917, as compared with nitrate contents of 331.5 lbs. in soil cultivated 3 in. deep and 445.7 lbs. in soils with a bare surface in 1916, and 372 and 361.2 lbs., respectively, in 1917. Further observations of nitrate formation in the soils of plats left to weeds and those plowed early (July) and cultivated led to the conclusion that the small amounts of nitrate found in the soil of the weed plats were due to the fact that the nitrates had been reduced by weed growth. Available data seemed to indicate that the depth of cultivation did not greatly affect nitric nitrogen accumulation in the soil of plats prepared in different ways for wheat.

Data similar to that compiled by Cates and Cox (E. S. R., 28, p. 233), relative to the effect of tillage on corn, have been obtained in experiments conducted at this station from 1914 to 1916, inclusive, and show that the uncultivated plats where the weeds were removed produced practically as high yields as the cultivated plats.

In summarizing, the authors state that "if moisture is lost from the soil principally through weed growth, and if nitrogen and other elements of plant food become available rapidly in unstirred soil, it is a matter of economy to handle the soil so that weeds may be controlled with the minimum of labor. It should not be understood that tillage is unessential. It will be necessary . . . to maintain the proper structural conditions of the soil, to dispose of crop residue on the surface of the soil, to incorporate manures and organic matter in the soil, and to place the soil in suitable condition for seed. Further than this, with the possible exception of heavy types of soil, it is doubtful if tillage is essential where the soil is in a receptive condition to absorb rainfall and where there is no weed growth."

A list of 19 titles is appended, comprising the literature cited.

Alkali soils: Some biochemical factors in their reclamation. J. H. BARNES and BARKAT ALI (*Agr. Jour. India*, 12 (1917), No. 3, pp. 368-389, pls. 5; *abstr. in Chem. Abs.*, 11 (1917), No. 22, p. 3082).—This is a full account of investigations, previously noted (E. S. R., 35, p. 516) from a briefer report, which indicate that the activity of the oxidizing, nitrifying, and nitrogen-fixing bacteria of the soil may be utilized as a simple and effective means of measuring the progress of the reclamation of alkali soils. The methods of making the tests are fully described, and laboratory and field tests in which they were successfully used to measure the progress of reclamation by washing and drainage are reported. The proposed procedure is based upon the conclusion that the salts present in alkali soils do not exert any toxic effect on the plant, harmful effects being observed only when the osmotic pressure of the saline solution exceeds that of the cell sap. The author maintains that this condition can be determined as well and more quickly and easily with soil bacteria than with the higher plants.

It was found that nitrifying organisms are comparatively resistant to the ordinary alkali salts and can withstand a solution of higher osmotic pressure than the higher plants. That is, increased nitrification begins in a soil before it is sufficiently freed of soluble salts to admit of the growth of ordinary crops. The ammonifying organisms were found to be still more resistant than the nitrifying organisms. Apparently all of the organisms affecting the nitrogen supply of the soil are present in alkali soils, but are dormant as long as the

soluble salts are in excess and immediately become active when the excess of salts is removed.

"The method adopted is not to attempt a count of the organisms present, but to measure their chemical activity under standard conditions. This involves the measurement of the rate of carbon dioxide formation, the rate of nitrification of ammonia both in a nutrient solution and in the soil, and the rate of nitrogen fixation. The figures so obtained give an index to the number and condition of the bacteria responsible for these important processes or will, in other words, be an indirect measure of the decrease in the osmotic pressure of the soil water, using for the test not merely one type of organism but all those responsible for the three chief chemical reactions necessary to the full fertility of the soil."

Some observations on the occurrence of infertility under trees, JATINDRA NATH SEN (*Agr. Jour. India*, 12 (1917), No. 3, pp. 390-405, pls. 5; *abs. in Chem. Abs.*, 11 (1917), No. 22, p. 3078).—Data are presented from observations on the occurrence of infertile spots under tamarind trees and bamboo clumps. They indicate that, while numerous factors were perhaps involved, the infertility in these particular cases was due mainly to the accumulation of soluble salts accelerated by the great transpiring power of the plants which removed the soil moisture, leaving behind the greater part of the soluble salts.

Results of fertilizer experiments conducted at the Pee Dee Station, T. E. KERR (*South Carolina Sta. Bul.* 193 (1917), pp. 3-24).—Rather extensive fertilizer experiments in progress at the Pee Dee substation are described, and the results obtained from the first rotation (1914 to 1916, inclusive) are reported. The experiments embrace four series each containing 45 tenth-acre plots. Three series consist of 3-year rotations of corn and cowpeas, oats followed by cowpeas, and cotton, and the fourth series of cotton grown continuously. Detailed tabulated data are presented and discussed, showing the yields obtained with each crop under the different fertilizer treatments, and comparisons are made of the effects of the different fertilizer ingredients used singly and in combination. The results in general are regarded as tentative. The more or less definite conclusions may be summarized as follows:

The addition of potash to phosphorus on this soil was beneficial in most cases where the rotation was used, but had little if any effect where cotton was grown continuously. Nitrate of soda used as a top-dressing gave good results generally when applied to cotton, both when grown continuously and in rotation, the results indicating that nitrogen is the first limiting factor in cotton production. Very little benefit was gained through the application of either muriate of potash or kainit alone, although marked increases of seed cotton were obtained from a combination of nitrogen and potash on cotton grown continuously. Neither ground limestone nor caustic lime proved to be profitable on this soil in either the common 3-year rotation or where cotton was grown continuously. Applications of lime failed to give increased yields of cotton even when a heavy growth of cowpea vines was incorporated with the soil. The best time for plowing under cowpea vines appeared to be after the peas were picked, rather than at the time of most luxuriant growth.

A simple way to increase crop yields, H. A. MILLER (*U. S. Dept. Agr. Farmers' Bul.* 924 (1918), pp. 24, figs. 10).—Cropping conditions on the impoverished light soils of the Coastal Plain area of New Jersey, Maryland, Delaware, and Virginia are described. The principal need of the region is said to be a liberal supply of organic matter obtained chiefly through the growing of leguminous crops such as crimson clover, cowpeas, soy beans, red clover, and hairy vetch; and of rye, buckwheat, or suitable grasses. Commercial fertilizers and lime are recommended when necessary to stimulate the growth of the soil.

improving crops. Improved cropping systems are outlined, and the results obtained from systems followed on some of the more successful farms of the region are described.

Our mineral supplies.—Nitrates, H. S. GALE (*U. S. Geol. Survey Bul. 686-Z* (1917), pp. 4).—This is a brief review of the nitrate situation in the United States, it being pointed out that there is in the United States no known natural source of nitrates that can be counted on to furnish any considerable supply of the refined nitrate salts. Imports and consumption in the United States for various purposes, including fertilizers and explosives from 1912 to 1916, are summarized and artificial nitrogen fixation processes reviewed. It is stated that while the electric arc fixation processes are fundamentally the simplest, a great amount of electric power is required. "It seems doubtful if the power available in this country could be spared for use in this way. . . ."

By-product ammonia, derived from the production of coke and of illuminating gas, is an important source of combined nitrogen and is an available source for the production of nitric acid or nitrates. Such ammonia can be practically oxidized to nitrates, and the supply of this material is therefore available to relieve emergency requirements should other sources fail."

Sulphate of ammonia: Its source, production, and use (*New York: The Barrett Co., 1917, pp. 23, figs. 19*).—This is a brief practical treatise on the sources, production, and use of ammonium sulphate, with particular reference to its use as a fertilizer.

Vegetation experiments on the availability of treated phosphates, J. G. LIPMAN and H. C. McLEAN (*Soil Sci., 4* (1917), No. 4, pp. 337-343, fig. 1).—Vegetation experiments on the availability of untreated ground rock phosphate, ground phosphate rock previously composted with sulphur, and acid phosphate are reported.

It was found that "some crops can utilize the phosphorus in floats to good advantage. This is particularly true of buckwheat. The ability of buckwheat to use effectively the phosphorus of ground, but otherwise untreated, phosphate rock suggests that this crop may be made a valuable green manure and employed to increase the content in the soil of organic matter and of available phosphorus. Ground rock phosphate properly composted with ground sulphur becomes a source of available phosphorus and may be employed to advantage as a substitute for acid phosphate."

Sixteen per cent acid phosphate, M. A. BACHTELL (*Agr. Col. Ext. Bul. [Ohio State Univ.] 13* (1917-18), fig. 4, pp. 15, figs. 7).—This bulletin, summarizing experimental work at the Ohio Experiment Station, states that from 600 to 1,000 lbs. of acid phosphate per acre can be used with profit during a rotation of three or four years on most Ohio soils, and that 16 per cent acid phosphate should not cost over \$16 a ton. Other practical information on the subject is given.

Explorations and studies of the beds of phosphorites in Russia, 1914, [A. V. SAMOÏLOV (*Otchet Geol. Izslédov. Fosfor. Zalezhei, 7* (1915), pp. 25+391, pls. 8, figs. 71; abs. in *Internat. Inst. Agr. [Rome], Internat. Rev. Sci. and Pract. Agr., 8* (1917), No. 4, pp. 561, 562).—This report for the year 1914 of the Commission for the Study of Phosphorite Beds (of the Agricultural Institute of Moscow), contains twelve detailed accounts of the phosphorite beds of many districts of Russia, made by various authors and enlarged with numerous figures, plates, and maps. An introduction by Samoilov summarizes the general results of the researches and explorations of 1914. The principal facts are summarized as follows:

In 1914 research work and explorations were carried out in the Provinces of Samara, Tambov, Kursk, Orel, and Kaluga, and in the districts of Turgai and the Ural Mountains. In each district the productivity of the beds, their

total surface area, the total quantity of phosphorites contained in the beds, and the corresponding total quantity of phosphoric anhydrid, were estimated. The phosphorites were divided into three groups, containing, respectively, from 12 to 18, from 18 to 24, and more than 24 per cent of phosphoric anhydrid. Among the phosphorites studied in 1914 those of group 2 were found in 13 out of 17 of the beds examined and usually contained 20 per cent of phosphoric anhydrid. The phosphorites of the other four beds belonged to group 1.

The districts examined in 1914 contained a total surface area of beds of 1,730 square miles, a total quantity of phosphorites of 1,730,000,000 tons, and a total quantity of phosphoric anhydrid of 283,000,000 tons. The average production was 7 cwt. per 10 square miles.

If the quantity of phosphorites estimated in the beds in 1914 be added to that of preceding years, a total of 5,020,000,000 tons is obtained, of which 68.1 per cent is in group 1, 29.2 per cent in group 2, and about 2 per cent in group 3.

The report ends with a study by Samoilov of the phosphorite beds of the right bank of the river Desna (Krolevets district, Chernigov Province). These beds on account of their origin, their form, the large accumulation of phosphoric nodules of various types, and the nature of the cementing body, possess particular scientific interest from a geological and mineralogical point of view.

Influence of carbonates of magnesium and calcium on bacteria of certain Wisconsin soils, H. L. FULMER (*U. S. Dept. Agr., Jour. Agr. Research*, 12 (1918), No. 8, pp. 463-504, figs. 11).—Investigations at the Wisconsin Experiment Station are reported in which the effect of magnesium and calcium carbonates, limestone, monocalcium phosphate, and dibasic magnesium phosphate (and in certain cases calcium and magnesium chlorids) on the number and activity (ammonia and nitrate formation and nitrogen fixation) of bacteria was studied with pure cultures and with the ordinary flora in acid Colby silt loam soil, acid Plainfield sand, and neutral Miami silt loam. "The calcium carbonate, magnesium carbonate, and limestone were added in amounts sufficient to satisfy one-fourth, one-half, and full calcium-carbonate requirement—that is, to neutralize one-fourth, one-half, and the total active acidity." The phosphates were added in varying amounts.

It was found that the number of bacteria in the acid silt loam and acid sand was increased by the applications of calcium carbonate, magnesium carbonate, or limestone, magnesium carbonate increasing the number to a much greater extent than either calcium carbonate or limestone. Monocalcium phosphate and dibasic magnesium phosphate slightly increased the number of bacteria in neutral soil.

Nitrification was promoted by adding limestone, calcium carbonate, or magnesium carbonate. In soils to which no nitrogenous matter had been added, magnesium carbonate favored nitrate accumulation more than either calcium carbonate or limestone. The phosphates increased the accumulation of nitrate nitrogen to a very small extent. When gelatin was added to the soil, magnesium carbonate did not increase nitrification any more than calcium carbonate or limestone. The three carbonates increased ammonification of blood meal by pure cultures of *Bacillus tumescens* and *B. subtilis* in sterile acid silt loam soil.

A culture of *B. azotobacter* failed to show an increase in total nitrogen in the acid sand treated with carbonates and mannit and only a slight gain in acid silt loam soil so treated. Pure cultures of *B. radiclecola*, of both alfalfa and lupine strains, and *B. azotobacter* were greatly benefited when inoculated into the sterile acid silt loam soil previously treated with magnesium carbonate or calcium carbonate. Limestone barely increased the number of *B. azotobacter*

in the acid silt loam soil. In neutral and acid soils made strongly alkaline with magnesium carbonate the increase in number of *B. azotobacter* was much greater than in the untreated soils.

The data in general show that magnesium carbonate was superior to calcium carbonate or limestone in stimulating the reproduction of bacteria in acid silt loam and acid sand soils. As a rule the smaller applications gave better results than the larger.

A list of 64 references to literature cited in the article is given.

Nitrification as a measure of the availability of different forms of calcium carbonate when employed as correctors of soil acidity. P. S. BURGESS (*Soil Sci.*, 4 (1917), No. 4, pp. 327-336, fig. 1).—Experiments conducted at the Hawaiian Sugar Planters' Experiment Station with coral sand and finely-ground coral limestone are reported.

It was found that "where no additions of nitrogen are made, coral sand and ground coral limestone are about equally effective in enhancing the nitrification of an acid soil's own organic nitrogen. After neutralizing Hawaii acid soils, the average amounts of nitrate formed over a period of five months under optimum conditions are comparatively small. The increment of gain in nitrate formed over the soil exactly neutralized, due to adding twice the amounts of lime required (either as coral sand or as ground limestone), is too slight to warrant double applications. Twice the required amounts of coral sand effect a greater increase in nitrate produced over the soils exactly neutralized than do twice the amounts of finely-ground coral limestone.

"Where coral sand was used in sufficient amounts to bring the soils to exact neutrality, the following percentages of gain over the soils to which no lime in any form was added, are indicated: No nitrogen added (soil's own nitrogen), 56 per cent; dried blood nitrogen added, 165 per cent; and ammonium sulphate nitrogen added, 398 per cent. Where finely-ground coral limestone was used to neutralize, the following percentages of gain over the 'no lime' cultures are indicated: No nitrogen added (soil's own nitrogen), 518 per cent; dried blood nitrogen added, 235 per cent; and ammonium sulphate nitrogen added, 608 per cent.

"Comparing the average percentage of increased nitrate production due to neutralizing exactly the soil with coral sand with that brought about by the addition of finely-ground coral limestone, where both ammonium sulphate nitrogen and dried blood nitrogen were supplied, we have, as a general average over the entire incubation period of five months, an increase of 281 per cent due to sand applications and an increase of 421 per cent due to ground limestone applications. From these figures a simple ratio shows that, when lime availability is measured in the soil by enhanced nitrification, 1 ton of the finely-ground limestone is practically equivalent, in neutralizing soil acidity, to 1.5 tons of the best grade of coral sand."

The principles of the liming of soils. E. C. SHOREY (*U. S. Dept. Agr., Farmers' Bul.* 921 (1918), pp. 30, figs. 6).—This presents information regarding the materials used in liming and their preparation, together with a discussion of the changes, so far as they are known, which are brought about in the soil by lime. The relative merits of different forms of lime and the factors which determine their use in farm practice are fully explained. A list of terms commonly used in the discussion of liming is included.

The use of lead for stimulating growth in plants. A. STUTZER (*Jour. Landw.*, 64 (1916), No. 1-2, pp. 1-8; *abs. in Jour. Chem. Soc.* [London], 110 (1916), No. 64, 1, p. 704; *Internat. Inst. Agr.* [Rome], *Internat. Rev. Sci. and Pract. Agr.*, 8 (1917), No. 6, pp. 844, 845; *Chem. Abs.*, 11 (1917), No. 8, p. 1008).—"Experiments carried out in 1914 and 1915 on the action of aqueous solutions of lead

nitrate showed that plants grew vigorously when treated with small quantities of lead. The maximum growth was obtained with 0.5 gm. of nitrate per liter of nutritive solution. Not only did larger quantities affect the development of the roots, but they also retarded that of the leaves. The same results were obtained in this respect with all the experimental plants, rye, wheat, oats, barley, maize, and peas. The difficulty of spreading the lead nitrate was overcome by making it into a fine powder and mixing it well with the potash salt or sodium nitrate used as manure. Manuring experiments with beets resulted in a certain increase in yield of both roots and sugar which could be attributed to the lead nitrate. Potatoes, on the other hand, proved very sensitive to the action of lead, which caused a decreased yield of tubers and starch."

In experiments with wheat in sandy loam, "the addition of 44 lbs. of nitric nitrogen to the basic manure increased the grain yield by 880 lbs.; 56 per cent of this nitrogen was assimilated. The addition of 9 lbs. of lead nitrate only increased the grain yield by 187 lbs. as compared with the basic manure and only 21.5 per cent of the nitrogen was assimilated. The addition of 66 lbs. of nitric nitrogen to the basic manure increased the grain yield by 1,320 lbs. and 82.3 per cent of the nitrogen was assimilated. In this case the addition of 9 lbs. of lead nitrate had a favorable effect on the grain yield, which it increased by 2,123 lbs. as compared with the basic manure. . . .

"There is nothing against the practical use of lead nitrate and, so long as the manufacturer can guarantee a uniform distribution of the lead, the mixing of lead nitrate with potash salts and sodium nitrate on a commercial basis is recommended."

Commercial stocks of fertilizer and fertilizer materials (*U. S. Dept. Agr., Office Sec. Circ. 104 (1918), pp. 12, figs. 5*).—This circular presents statistical information obtained through the War Emergency Fertilizer Survey of October 1, 1917, regarding the stocks on hand and in transit; the quantities under contract or option for delivery before April 1, 1918; comparative figures based on returns from concerns reporting for both 1916 and 1917; imports; and production of nitrate of soda, potash, sulphuric acid, sulphate of ammonia, slaughterhouse and garbage tankage, sulphur, foreign and domestic pyrites, acid and rock phosphate, mixed fertilizers, cottonseed meal and cake, dried blood, raw and steamed bone, fish scrap, cyanamid, and base goods.

The returns for 1917 showed an increase over 1916 in commercial stocks of potash, sulphate of ammonia, and acid and rock phosphate, while a marked decrease was noted in the case of nitrate of soda, mixed fertilizers, dried blood, slaughterhouse and garbage tankage, and to a less degree of sulphuric acid and foreign and domestic sulphur and pyrites.

Peat in 1916, J. S. TURNER (*U. S. Geol. Survey, Min. Resources U. S., 1916, pt. 2, pp. 289, 290*).—Statistics regarding the use of peat as fertilizer and fertilizer filler, stock food, and litter in the United States during 1916 are given. Of the total consumption of 55,548 short tons, 48,106 tons was used as fertilizer and fertilizer filler, as compared with 38,304 tons in 1915.

AGRICULTURAL BOTANY.

Significance of colloidal chemistry in physiology, W. CROCKER (*Trans. Ill. Acad. Sci., 8 (1915), pp. 47-68*).—This paper deals with the colloidal nature of living cells, general characteristics and water relations of cell colloids, diffusion in a colloidal medium, enzymes and immunity bodies as colloids, some colloidal phenomena of soils, and topics in colloidal chemistry and their bearing upon physiology (as in aging seeds), giving a bibliography of the subject.

Osmotic pressure in animals and plants. W. R. G. ATKINS (*Sci. Prog.* [London], 11 (1917), No. 44, pp. 562-577).—Summing up observed results in comparative studies of osmotic pressures in animal and plant cells, the author notes that in this respect, as well as in other phases of their physiology, there is an abbreviated recapitulation of phylogeny in case of members of each division, notwithstanding the difference in the conditions under which the two great divisions of living matter have developed.

It is stated that in animal cells the upper limit of osmotic pressure is not far from 7.5 and that within the body each cell may be considered as a water dweller, being in osmotic equilibrium with the other cells and the intercellular solutions. In primitive naked plant cells, in free sperms, and in unfertilized ova, the osmotic relationships are much the same as those for lower animals. In case of higher plants, however, the presence of a comparatively inextensible cellulose wall brings about entirely new conditions (which are discussed), and as a result very great differences as regards osmotic pressure exist in the different tissues. In this division a very great part of this osmotic influence is due to nonelectrolytes, sugars preponderating. The effect of light upon chlorophyll-bearing organs is considered by far the most powerful of the many causes which influence osmotic pressure in plants.

The main purpose of this paper is to emphasize the differences existing as regards osmotic pressure in animals and in plants.

Carbon assimilation, I. JØRGENSEN and W. STILES (*New Phytol.*, 14 (1915), Nos. 8-9, pp. 240-250; 10, pp. 281-294; 15 (1916), Nos. 1-2, pp. 11-23; 3 4, pp. 35-36; 5-6, pp. 117-135, figs. 6; 7, pp. 144-160, figs. 7; 8, pp. 176-193; 9-10, pp. 205-232, figs. 4; 16 (1917), Nos. 1-2, pp. 24-45, fig. 1; 3 4, pp. 77-104).—This is mainly a review of recent work by different investigators on the pigments of the green leaf and on the processes connected with them.

Buffer processes in the metabolism of succulent plants, JENNY HEMPEL (*Compt. Rend. Lab. Carlsberg*, 13 (1917), No. 1, pp. 150, figs. 16).—The author gives an account of investigations carried out on plants subjected to widely different external conditions, designed to determine the concentration of hydrogen ions in the cell sap extracted from leaves and the relation of such concentration of hydrogen ions to the quantity of contained acid as shown by titration, and to estimate the importance of such relation.

It is stated that in the sap from leaves of succulent plants the concentration of hydrogen ions varies, but is determined by the quantity of titratable acid and the quantities of dissociated malates. In certain saps (possibly in all succulents) acid is never associated with acid salt, though varying quantities of acid salt and normal salt occur together in a mixture of a marked buffer character. The faculty of producing and accumulating acids varies greatly in succulents. It may stand in causal relation to the quantity of dissociated malates. Species vary greatly as regards the distance between the litmus and phenolphthalein points as shown by titration, older leaves sometimes exceeding younger ones in this respect, and the quantity of aluminum malate appearing to be influential in this respect. Sap from seedlings of lupines (*Lupinus albus*) showed nearly uniform values for the concentration of hydrogen ions. Fluid from nonstimulated pitchers of *Nepenthes* showed indefinite concentrations of hydrogen ions as contrasted with the fluid from pitchers subjected to stimulus. By means of lacmoid paper an approximate value is obtainable for the concentration of hydrogen ions in a liquid when such concentration falls within certain limits.

A study of stomata, L. REHFÖRS (*Bul. Soc. Bot. Genève*, 2, ser., 3 (1917), No. 4-6, pp. 245-350, figs. 135).—The author gives an extended account of

studies on stomatal characters and related phenomena as carried out in a number of families of plants.

It is held that stomatal structure in a given natural group possesses a remarkable fixity, being an expression of ancestral characters rather than of local and temporary adaptations. The characters marking some families are cited as illustrating this fact. The Polypodiaceæ are thought to constitute a special group in some respects. A striking analogy is noted between the stomatal characters of Cycadaceæ and those of conifers.

The nature of tendrils and the formation of branch nodes, Y. ONYOKA (*Bul. Inst. Oinoue, Num. Extra, 1917, pp. 27, figs. 42*).—The author concludes from the study here described that tendrils are anticipatory buds transformed into tendrils during the course of evolution. Bifurcation of a branch is simply a vegetative partition of the tip due to surplus vigor in the part. The probable course of ancestral development in these parts is briefly traced.

Slow changes in buried grapevines, E. PANTANELLI (*Staz. Sper. Agr. Ital., 49 (1916), No. 12, pp. 605-648, pls. 4*).—Tests with varieties of grapevines are outlined with a brief account of the results, which indicate that *Rupestre* is very resistant to decomposition after the death of the tissues. The most characteristic change is humification, affecting the protoplasmic contents of the cells. Maceration is most rapid in the parenchyma. Aeration favors humification. The invasion of microorganisms, especially of fungi, accelerates the process, which is hindered by sterilization in the autoclave. Changes in the chemical contents are also indicated.

A method of prophesying the life duration of seeds, J. F. GROVES (*Trans. Ill. Acad. Sci., 8 (1915), pp. 133-136, fig. 1*).—This is a continuation of the work previously noted as done by the author with Crocker (*E. S. R., 33, p. 128*). Turkish Red wheat was employed in these two series of tests.

Increased time of heating shows a delay in germination as well as a fall in germination percentage, which is also true of seeds stored for a long time at room temperature. A comparison of the life duration at various temperatures, as found by experiment with the calculated life duration, shows a close agreement between the two sets of values. It is thought, therefore, that the time-temperature formula for protein coagulation may be applied as a formula for the temperature-life duration for seeds; though, in order to establish the general application of this principle, much more work is regarded as needed and several influential factors need to be considered, as outlined in the previous work.

Electromotive phenomena in plants, A. D. WALLER ET AL. (*Rpt. Brit. Assoc. Adv. Sci., 86 (1916), p. 305*).—The object of the work of this year, as reported by the committee, was to determine whether or not a sufficiently strong electrical response is obtained by employing the whole seed in germination tests. Results are given of six tests with the whole pea and with the extracted radicle showing that the response of the radicle was much greater in the latter than in the former.

Experimental studies in the physiology of heredity, F. F. BLACKMAN ET AL. (*Rpt. Brit. Assoc. Adv. Sci., 86 (1916), p. 306*).—In this report of the committee regarding the work of the year on *Primula sinensis*, it is stated that progress has been made in several directions. A new form has been produced, fulfilling a prediction previously made. The gap between the ordinary fully hoary type of stock and the wallflower-leaved variety is gradually being bridged by experimental breeding.

Studies of inheritance in *Pisum*.—II, The present state of knowledge of heredity and variation in peas, O. E. WHITE (*Proc. Amer. Phil. Soc., 56 (1917), No. 7, pp. 487-588*).—The object of the present bibliographical review

is to summarize the large amount of knowledge recently gained and to correlate this with that which was available at the time of Lock's summary in 1908 (E. S. R., 20, p. 629), in order to show the progress made and to indicate what really is the basis of the Mendelian analysis of *Pisum*. Thirty-six hereditary factors as recognized and represented are dealt with and the available data are interpreted.

Biocharacters as separable units of organic structure. H. F. OSBORN (*Amer. Sci.*, 51 (1917), No. 608, pp. 449-456).—The purpose of this synopsis is said to be to bring together and review some of the noteworthy phenomena of character separability as contrasted with those of interdependence, cooperation, correlation, and coordination. The author proposes the term biocharacters as the general designation of the character unit in the organism. These are discussed as observed in paleontology, and also in regard to their modes of separability in heredity, in genesis, and in rate of evolution of forms.

It is claimed that biocharacters are separable in origin, development, evolution, and heredity. They are separable through their many modes of origin from the germ, either saltatory, gradational, or continuous. They have different rates of motion, or velocity, in individual development (ontogeny), exhibiting acceleration or retardation. They have different rates of evolution in different phyla, again exhibiting acceleration or retardation. All the biocharacters cooperate through different modes of grouping in functional correlation, in compensation, and in sex linkage. In the hard parts of the body, while the biocharacters of form and proportion may originate through continuity, through saltation, or through minute gradations, all the known evolution of proportion biocharacters is continuous. In the hard parts the biocharacters of rectigradations have been observed to originate and develop only through continuity.

Studies on self-sterility.—I. The behavior of self-sterile plants. E. M. FAWC and J. B. PARK (*Genetics*, 2 (1917), No. 6, pp. 505-609). This investigation and the conclusions therefrom have been limited to the self-sterile species *Nicotiana forgetiana*, *N. alata*, *N. glutinosa*, and *N. angustifolia* bred among themselves, all questions connected with the relation between true self-fertility and self-sterility being considered as constituting a distinct problem.

The tendency to self-sterility is regarded as inherited, these four species breeding true to the quality. This is expressed in these plants from the beginning of the flowering season, though toward its close some self-fertility may be shown, especially in plants exhibiting the effects of adverse environmental conditions. This phenomenon, which is called pseudo self-fertility, is considered as a noninherited fluctuation. Self-sterility, whatever its nature may prove to be, is regarded as only a physiological impediment to self-fertilization. The fact that the waning of the reproductive period affects *N. alata* and *N. glutinosa* more markedly than the other two species is regarded as indicating multiple allelomorphism in a fundamental factor, the presence of which is necessary to the development of self-sterility. Cross-sterility, identical in its nature with self-sterility, was found in every population of self-sterile plants tested. Self-sterility behaves as a sporophytic character. Part or all of the individuals resulting from one mating may be fertile with one or both parents. It is stated that if A is sterile with B and C, the last two will be sterile when bred together. A varied series of facts observed in this connection is detailed, with discussion.

Ecology and physiology of the red mangrove. H. H. M. BOWMAN (*Proc. Amer. Phil. Soc.*, 56 (1917), No. 7, pp. 589-672, pls. 6, figs. 3).—This is an account of the discussion of a study carried on since 1915 by the author on the red mangrove, *Rhizophora mangle*, which is claimed to be a plant of economic importance (E. S. R., 37, p. 821).

The thickenings of the cortex cells of the submerged absorptive roots are claimed to be really artefacts due to a slight shrinkage of the walls of the delicate transfusion cells. The pollen shedding device is explained. The endosperm is considered as a placental organ rather than as reserve material. The high mortality in specially concentrated media is due in H_2S mud cultures to increased hydrogen ion concentrations, and in hyperconcentrated sea water to the difficulty of absorption and retarded metabolism. In moist soil cultures the transpiration rate is delicately balanced by available soil moisture. No definite inverse proportion was maintained between tannin and dextrose during the growth of the seedling. Tannase tests seemed to show that tannin does not serve as reserve food in the hypocotyl. Red mangrove is facultative as regards its growth in fresh or salt water, though it requires the latter for its optimum development.

A cyanogenic *Mucor*, H. GUYOT (*Bul. Soc. Bot. Genève*, 2. ser., 9 (1917), No. 1-3, pp. 30-35).—A further account is given of the fungus previously reported (E. S. R., 36, p. 734), which is now technically described as a new physiological species, *M. cyanogenica*.

A comparison of certain Rocky Mountain grasslands with the prairie of Illinois, G. D. FULLER (*Trans. Ill. Acad. Sci.*, 8 (1915), pp. 121-150).—The author makes some comparisons between Rocky Mountain grasslands and the prairies of Illinois. He states that these regions agree as regards conditions of rainfall and humidity and as regards summer deficiency in soil moisture, both showing a well-marked hydrarch succession passing from the aquatics through the sedge moor in a closely comparable series of associations, and both possessing a climax prairie meadow association in which herbaceous species other than grasses are fairly abundant. The two regions differ in altitude, temperature, length of growing season, and soil. The mountain region shows fewer aquatic species and a xerarch succession comparable to nothing noted in Illinois.

A study of the vegetation of southeastern Washington and adjacent Idaho, J. E. WEAVER (*Univ. [Nebr.] Studies*, 17 (1917), No. 1, pp. 114, pls. 19, figs. 17).—This is an account of ecological observations made during 1912 to 1914 on the three principal plant formations and subdivisions thereof occurring in this region.

The vegetation of Paraguay, R. CHODAT and W. VISCHER (*Bul. Soc. Bot. Genève*, 2. ser., 9 (1917), Nos. 1-3, pp. 55-107, figs. 46; 4-6, pp. 165-244, figs. 60).—Some results are detailed of the work of a Swiss expedition for botanical study in Paraguay, this account being confined to the Malpighiaceæ, the Podostemaceæ, and the Bignoniaceæ.

FIELD CROPS.

Cropping systems for the moister portion of eastern Washington and Oregon and northern Idaho, L. W. FLUHARTY (*U. S. Dept. Agr. Bul.* 625 (1918), pp. 12).—Three and four year crop rotation systems are outlined in which clover is substituted for the common summer-fallow method of growing cereals in the region adjacent to the Bitter Root and Blue Mountains in Washington, Oregon, and Idaho. This region has an annual rainfall of 20 in. or more, and comprises an area of approximately 1,875,000 acres of improved farm land. A farm survey made in 1915 on 246 farms in a representative portion of the district showed that 30.2 per cent of the rotation area was idle each season as summer fallow, while observations on a few farms where clover was employed in the rotation as a substitute for summer fallow showed an increase per acre in crop yields following this practice of from 15 to 25 per cent.

A study of the effect upon the profitableness of farming of different amounts of idle land in summer fallow indicated that the interest on investments varied from 5.9 per cent on farms having 46.5 per cent of the rotation area in summer fallow to 8.3 per cent for those having only 6.4 per cent of the area idle, with respective labor incomes of —\$200 and \$490. With respect to the per acre yield of crops, the interest on investments varied from 5.5 per cent for an average crop index (crop yield as compared with average of all farms taken as 100) of 79 to 8.2 per cent for a crop index of 122, with labor incomes of —\$220 and \$480, respectively. It is concluded, therefore, "that any cropping system which either will increase yields or reduce the amount of land devoted to summer fallow without decreasing the crop yields will materially increase farm profits on these farms."

The effect on crop yields of eliminating summer fallow is noted as indicated in a farm survey made in 1912 on 144 silt loam soil farms in the Willamette valley, Oreg. The crop index for farms without summer fallow was found to be 101, as compared with 96 for farms with summer fallow, wheat being the only crop to produce more per acre with summer fallow than without it. The introduction of legumes, principally clover, into the rotation was regarded as the determining factor in these results, the crop index ranging from 82.8 for farms with no legumes to 111.4 for those with 44.8 per cent of the crop area in legumes. In a study of the field crop area in clover in relation to farm profits and yields, the average labor incomes varied from —\$135 to \$500, and the crop index from 95.8 to 110.7, for farms with no clover and those with 32.7 per cent of the field crop area in clover, respectively.

Clover seeded with four different nurse crops produced a successful stand on 75.9 per cent of the area seeded in winter wheat, on 96.5 per cent of that seeded in spring wheat, on 89.7 per cent of that seeded in oats, and on 97.8 per cent of that seeded in barley. The principal factors contributing to the failure of clover seeded with a nurse crop are said to be foul land, poor seedbed preparation, too thick seeding of the nurse crop, poor seed, late seeding, and lack of proper soil inoculation. The pure culture and the field soil methods of inoculating clover are briefly described, and the production of clover for seed is discussed.

Crop rotation investigations.—Field T experiments, A. C. ARNY (*Minnesota Sta. Bul. 170 (1917), pp. 3-55, figs. 3*).—This reports the results of crop rotation experiments extending over a period of six years, 1909 to 1914, inclusive, and embracing a study of different cropping systems, tests of commercial fertilizers in addition to barnyard manure for good rotations, and observance of methods of tillage and manuring. Rotations of 2, 3, 4, 5, and 7 years' duration were inaugurated, employing wheat, oats, corn, potatoes, flax, and timothy and clover for hay and pasture, and are compared with continuous cropping schemes, including oats, wheat, oats and wheat mixed, corn, and mangels. With certain exceptions, manure has been applied to each rotation and cropping system at the rate of 2 tons per acre per year. The fertilizer experiments were conducted on a standard 3-year rotation of oats, clover for hay, and corn, and included tests of complete commercial fertilizers, used with and without manure, and of raw rock phosphate, acid phosphate, muriate of potash, and nitrate of soda used singly with 6 tons of manure per acre. The same standard rotation was employed for the tillage and manure experiments, and the usual method of tillage, fall plowing the meadow for corn, and double disking corn land for oats, was adopted as a standard and compared with spring plowing for corn and fall and spring plowing for oats. Observations were also made of rotations without manure, of manure applied to the meadow, of pasturing off the grass, and of

broadcasting *v.* drilling grass and legume seed with grain. Considerable tabulated data are presented and fully discussed, showing both crop yields and values for the various treatments outlined.

The results may be summarized as follows: Rotations of grains, clover, timothy hay, and cultivated crops, with moderate applications of manure, maintained yields, and with one exception returned a net income of \$8.76 over per acre. Cropping systems of different grains alternated, or of grain and corn alternated with moderate applications of manure but without clover, did not maintain yields, although an average net income of \$7.75 per acre was realized. The yields of grain and corn grown continuously, with moderate amounts of manure, have been consistently lower than those obtained in the better rotations, and somewhat lower than those secured from rotations of grains only or grains and cultivated crops only. The average net income per acre has been \$2.84 for wheat, \$5.15 for oats, and \$8.95 for corn. A 4-year rotation of oats, wheat, clover hay, and corn showed increased yields on the same crops grown continuously of 13.7 per cent for corn, 14.95 per cent for oats, and 30.98 per cent for wheat, and increases in the net income per acre of 29.2 per cent, 35.2 per cent, and 72.3 per cent, respectively. Mangels grown continuously with annual applications of 6 and 12 tons of manure per acre respectively, did not in either case yield a product equal to the cost of production.

An average net return of \$11.95 per acre was obtained from a 3-year rotation of oats, clover hay, and corn, with 6 tons of manure per acre applied preceding the corn crop. A complete commercial fertilizer in place of the manure gave practically the same yields, but at a financial loss of \$3.44 per acre. Raw bone phosphate, acid phosphate, muriate of potash, and nitrate of soda applied singly, in addition to the manure, resulted in losses amounting to \$4.59, \$3.74, \$4.83, and \$11.37 per acre, respectively. A complete fertilizer used in addition to the manure resulted in a loss of \$8.84 per acre.

A consistent lowering of corn yields during the last four years of the experiment was observed in the rotation without manure. Manure applied to timothy in the spring of the year and preceding corn, failed to increase appreciably the hay yield and resulted in a lowering of corn yields. Pasturing off the corn crop as compared with removing two hay crops gave no increase in yield of corn or corn. There was no appreciable difference in the yields of corn on old or early spring-plowed clover sod, although fall plowing is deemed the best farm practice. Oats were not so satisfactory on double-disked spring-plowed corn land as on double-disked fall-plowed land or as on corn land double-disked only. On weedy, infertile, or compact corn land, plowing for grain crops is deemed preferable to double diskings only. The stands of clover and timothy and the yields of hay were less satisfactory when sown with oats on double-disked spring-plowed corn land than on double-disked fall-plowed land or on corn land double-disked only. Yields of hay from clover and timothy sown broadcast averaged 2.65 tons per acre, while that drilled with the grain, in a 3-year rotation, averaged 2.89 tons.

The author concludes from these results that "adopting a systematic rotation of crops in which is included clover and timothy for hay or pasture will ordinarily result in as large a total yield of grains and corn each year as formerly, when the acres were cropped largely to grain and corn only. The net income per acre from the grains and corn grown in rotation with clover or similar legumes may be expected to be higher than from the same crops grown continuously or in rotations not including clover."

[Report of field crops work in Hawaii], F. G. KRAUSS (*Hawaii Sta. Rep.* 1917, pp. 29-31, pl. 1).—Field tests with leguminous and nonleguminous crops

forage and green manure are noted as conducted both at the demonstration farm at Haiku and in cooperation with farmers. The crops used in these tests included cowpeas, velvet beans, peanuts, soy beans, alfalfa, pigeon peas, jack peas, Japanese cane, Sudan grass, *Paspalum dilatatum*, and corn.

Among the most promising cowpea varieties are the Brabham and Iron for green and green manure, the Groit and Taylor for seed, and the Whippoorwill as a general-purpose sort. The Brazilian velvet bean, the Improved Valencia peanut, the jack bean, and the pigeon pea are said to be well established. *Alfalfa* did not thrive on the raw uplands, but of 10 varieties tested smooth leaf hairy Peruvian gave the most promise. All varieties responded to liberal manuring and fertilizing with phosphate, but liming and artificial inoculation appeared to have no beneficial effect. Japanese cane and *Paspalum* are deemed preferable to Sudan grass, due to the susceptibility of the latter to rust.

Corn sown in 30-in. rows on a medium loam soil and receiving about 60 tons of green manure in the course of three years and 500 lbs. of high grade fertilizer seedling time produced at the rate of 100 bu. per acre, as compared with an average yield of about 35 bu. per acre on virgin soil. Slightly less than one-fifth of the yield of the 30-in. rows was obtained from corn sown in 60-in. rows on all other conditions identical. This difference in yield is thought to be due to the added protection against strong winds afforded by the narrow spacing. Tests were made with grain sorghums, millets, buckwheat, and sunflower for stock feed and with wheat, oats, barley, and rye, the last proving totally suited to local conditions.

A strain of Bliss Triumph potato has been developed, and is said to be well established in the Kula potato district. More than 50 per cent increase in yield noted from spraying with Bordeaux mixture.

Report of [field crops work at] the Glenwood substation, J. B. THOMSON (Hawaii Sta. Rpt. 1917, pp. 42-48, pls. 2).--Field tests with various crops to determine suitable forage for dairy cows are reported in continuation of work previously noted (E. S. R., 37, p. 132), and additional work is described on the development of blight resistant strains of potatoes for the Glenwood section.

The area planted to *Paspalum dilatatum* was extended at an estimated cost \$125 per acre, the relatively high initial cost being deemed justified by the permanent nature of the grass. The common bamboo grass (*Panicum palmifolium* or *Chatochloa palmifolia*) is said to possess considerable value as a stock crop, being extremely palatable to stock. It is a prolific seed bearer. With clean cultivation and fairly liberal applications of stable manure, this grass gives promise of very satisfactory yields during the cold season, one crop tested from a small area yielding at the rate of 23.5 tons per acre. Canadian peas have proved to be of value when planted during the cold season the year on soil treated with heavy applications of stable manure. Improved Welsh oats sown November 20, 1916, on soil which had received about 50 tons of stable manure per acre, produced approximately 24 tons of green feed per acre on April 9, 1917. Subsequent plantings made on December 12 and 28, 1916 and on January 16, 1917, are said to have given excellent returns. Speltz and spring rye produced yields of green feed of 15,687 and 17,430 lbs. per acre, respectively, after a growing period of 4.5 months. Both crops were badly infested with aphids, and are not deemed comparable to oats. Thousand-headed and Dwarf Essex rape drilled in rows on November 20, 1916, and transplanted on January 5, 1917, made a vigorous growth during the cold season and yielded at the rate of 19.5 and 22 tons of green feed per acre, respectively. A planting of Dwarf Essex rape made in April was totally destroyed by cutworms. Seedlings of different species of bur clover were made in November, 1916, and included *Medicago scutellata*, *M. orbicularis*, *M. arabica*, *M.*

Aspida, *M. hispida sardoa*, and *M. tuberculata*. *M. scutellata* was the first to reach maturity, but is described as ranking lowest in forage production.

Two varieties of potatoes of the so-called "Hamakua Hybrid" designated as Blue Ribbon and White Ribbon, respectively, were grown in comparative tests for blight resistance with Portuguese Red and five common white varieties. The hybrid varieties and the Portuguese Red exhibited a marked degree of resistance and outyielded the white varieties in every instance.

Report of the agronomy division, C. A. SAHR (*Hawaii Sta. Rpt. 1917*, pp. 48-55, pl. 1).—This reports the continuation of previous work (E. S. R. 37, p. 131).

In a study of soil aeration with rice, the increases favoring nonaeration in 1916 were 18.7 per cent for the spring crop, and 4.9 per cent for the fall crop, and in 1917 3.1 per cent for the spring crop.

Plantings of Burbank and Early Rose potatoes produced average yields of 0.47 lb. per hill for both varieties, due to an attack of mites and to dry weather. Three varieties of sweet potatoes were propagated for cuttings for distribution.

Individual yields of alfalfa varieties, based on 9 cuttings per annum for a period of 32 months, were obtained as follows: Utah Common 30 tons of green forage per acre, Kansas Common 28.4 tons, Peruvian 21.7 tons, and Turkestan 14.7 tons. From the same number of cuttings for a period of 2 months, yields of Grimm, dry-land, and common alfalfa were obtained amounting to 26.6, 26.4, and 9.3 tons per acre, respectively.

Tests with tepary beans for seed have given varying results. A fall seeding made a growth of 9 in., the plants dying before reaching maturity, while a second seeding drilled in rows 1.5 ft. apart failed to fill the space between the drills, but yielded at the rate of 10 bu. of shelled beans per acre. In a third test made under drier conditions, with the beans drilled in rows 2 ft. apart at the rate of 15 lbs. per acre, the crop attained maturity in 76 days and yielded at the rate of 33.4 bu. per acre.

A new variety of pigeon pea introduced from India is said to have given favorable results.

Brief notes are given on limited field tests with various grasses including *Polytrias pramorsa*, blue couch (*Digitaria didactyla*) Napier (*Pennisetum purpureum*), Wilder, fuzzy top, Australian blue, and Natal redtop. In sorghum variety tests Sugar Drip was again first in yield of both grain and forage. Nut grass control by spraying with a solution of 1 lb. of white arsenic and 0.5 lb. of caustic soda in water to make 20 gal. when the plants were in full bloom necessitated treatments at average intervals of 40 days the first year and 65 days the second year. The third year, an interval of 9 months had elapsed since the last spraying without the appearance of any blooms.

Variety and fertilizer tests with corn failed completely due to severe attack by the leaf hopper (*Peregrinus maidis*), although the infestation was sufficiently controlled by means of parasites (*Ooetrastichus* sp.) to obtain a crop of sweet corn, the yield being at the rate of 43 bu. per acre.

Small plantings of edible canna yielded at the rate of 23 tons edible tubers, 20.5 tons immature tubers, and 20.25 tons forage per acre.

A white sweet variety of cassava from Trinidad and a red bitter sort common to the islands, planted in the summer of 1915 and harvested in March, 1917 yielded at the rate of 31 and 16.25 tons fresh roots per acre, respectively.

A study of forage-crop problems was begun in July, 1916, on the military reservation at Castner, Oahu, and experimental plantings were made of numerous leguminous and nonleguminous forage crops. Chemical soil analyses showed from 1.24 to 6.02 per cent of manganese dioxide in the surface soil.

first foot) and from 0.7 to 3.67 per cent in the subsoil (second foot). Of the crops sown in the summer only pigeon peas and Japanese cane made satisfactory growth, all others failing completely after a period of about 70 days' stunted growth. Fall seedings resulted in good stands, but no better growth was made than in the case of the summer plantings, except on small scattered areas where brush piles had been burned. The stimulated growth observed in these areas led to rather extensive studies of the effect of burning brush in ditches and on the level surface of these soils and incorporating the ashes with the soil. A comparative test of stable manure applied at the rate of 33 tons per acre in ditches 1 ft. deep and rolled level was also included. Various crops, numbering 45 in all, and including grasses, oats, wheat, Japanese millet, edible canna, sorghums, cassava, and legumes, were grown on soils receiving the various treatments, and the resulting growth is indicated in tabular form on a basis of 100 per cent for normal growth under normal soil and moisture conditions. The best average results for all crops were obtained from the manured plots, while burning over the ditched and level soil resulted in increased production over the untreated checks for practically all the crops. Observations are also noted on the effect of iron compound sprays on the various forage crops grown on manganese soils. Alfalfa sprayed with copperas every two weeks during April and May showed a slight effect previous to a cutting made June 2, but not on later growth, while on Japanese cane the effects were quite marked.

Progress report, Substation No. 7, Spur, Tex., 1900 to 1914, R. E. DICKSON *Texas Sta. Bul. 218 (1917), pp. 7-33, figs. 71*.—This reports the results of variety and cultural tests with alfalfa, Sudan grass, grain and forage sorghums, cotton, corn, small grains, and cowpeas; and of field experiments on time and methods of seed-bed preparation, and on manuring. The average annual precipitation for the 20-year period 1895 to 1914, inclusive, was 21.73 in., of which 15.17 in. fell during the six summer months. The average date of the last killing frost in the spring was March 18, and the first in the fall, October 25, for the period 1911 to 1914, inclusive. Much of the experimental work reported was conducted during 1914, when a total precipitation of 34.63 in. obtained.

The successful production of alfalfa is deemed the most important contribution of the substation to the agriculture of the State, a 4-year-old field giving a total yield of 3.74 tons of hay per acre in 1914. Fall seeding is said to be much more desirable than spring seeding. In the fall of 1913 alfalfa sown in close drills and in 18 and 36 in. rows showed average yields amounting to 2.27, 1.42 and 1.22 tons of hay per acre, respectively. Yields of cured hay, ranging from 1.72 tons for Province to 2.96 for Turkistan, were obtained in variety tests conducted during 1913-14. A seeding rate of 10 lbs. per acre is deemed amply sufficient on a well prepared seed bed, while excellent results are said to have been secured with a rate of 4 lbs. per acre.

Seeding Sudan grass for hay in 18-in. rows, broadcast, and in 36-in. rows resulted in yields amounting to 4.927, 4.551, and 4.204 tons per acre, respectively. A seeding rate of 14 lbs. per acre gave a slightly heavier yield, 5.14 tons of hay, than rates of 7, 18, 22, 32, or 40 lbs. Sudan grass was also grown in close drills and in 36- and 18-in. rows for seed in 1914, and resulted in yields of 989.5, 733.5, and 847 lbs. per acre, respectively. A seeding rate of 22 lbs. with a yield of seed of 1,209 lbs. was found to be superior to rates of 7, 14, 18, 32, or 40 lbs. per acre.

In grain sorghum variety tests, Dwarf Yellow milo, feterita, and Dwarf White milo gave average yields of 50.58, 40.58, and 37.32 bu. per acre, respectively. Red Kafir, with a yield of 15.46 tons of green forage per acre,

Kafir corn with 14.52 tons, and Dwarf Kafir with 14.27 tons were first in tests for silage production in 1914. In rate-of-seeding tests with Dwarf milo and Blackhull Kafir, the highest yields, amounting to 68.21 and 58.51 bu. per acre, respectively, were obtained with the plants 11.2 in. and 14.3 in. apart in 3-ft. rows. Milo maize and Kafir corn planted in 3-ft. rows produced 50.53 and 46.28 bu. per acre, respectively, as compared with yields of 46.45 and 39 bu. when planted in 6-ft. rows. Date-of-planting tests with milo maize showed yields ranging from 51.59 bu. for plantings made May 7 to 21.44 bu. for those made July 15. Variety tests with saccharin sorghums resulted in maximum yields of 6.068 and 6.051 tons of cured roughage per acre for Orange and Sumac, respectively. Further tests of the same varieties for silage showed yields of green forage amounting to 15.79 tons per acre for Sumac and 14.46 tons for Orange.

Cotton variety tests conducted during 1912 and 1914 showed average yields of seed cotton ranging from 703.4 lbs. per acre for long staple to 1,003.57 for Cleveland Big Boll. Based on factors other than yield, Lone Star and Mebane Triumph are deemed best for local conditions, pending further trial. Half-and-Half is regarded as decidedly inferior to these varieties. The highest yield of lint cotton, 573.69 lbs. per acre, obtained in rate-of-thinning tests was secured with the plants thinned to 16 in. apart in 36-in. rows.

June corn and yellow dry-land corn grown during 1914, an unusually favorable year for corn in this region, gave yields of 29.2 and 7.9 bu. per acre, respectively. Variety tests with wheat, barley, emmer, rye, and oats are held to indicate that the winters are usually too long and dry for the successful production of small grains. Turkey, Kharkof, and Crimean winter wheats and Tennessee winter barley are regarded as showing some promise.

New Era and Early Buff cowpeas, with yields amounting to 12.22 and 12.6 bu. of seed per acre, respectively, are deemed best for this locality.

Date-of-plowing tests for seed-bed preparation are described and are held to indicate the need of early seed-bed preparation. Cotton yields varied from 753.84 lbs. of lint cotton per acre for November 21 (1913) plowing to 593.29 lbs. for April 2 (1914) plowing; yields of Sumac sorghum for hay varied from 7.1 tons for February 2 plowing to 6.02 tons for April 2 plowing, and for silage from 19.09 to 17.25 tons per acre, respectively; and yields of cowpeas from 10.41 bu. of seed per acre for the February 2 plowing to 7.5 bu. for the April 2 plowing. Various methods of seed-bed preparation for milo maize were tested; the highest grain yield, 73.9 bu. per acre, being obtained from fall-listed plats, and the highest yield of green forage, 16,300 lbs., from plats fall-plowed 6 in. deep. Spring listing, as compared with January plowing, 3, 6, and 9 in. deep, for cotton resulted in yields of lint cotton amounting to 589.21 lbs. per acre for the former method and a maximum yield of 548.15 lbs. for January plowing 3 in. deep. Fall plowing as compared with fall listing for cotton gave average yields amounting to 737.51 and 734.57 lbs. of seed cotton per acre, respectively.

Applications of 2 tons of manure per acre to feterita gave yields of grain amounting to 39.73 bu., and of dry forage of 14,196 lbs. per acre, as compared with yields of 35.09 bu. of grain and 13,512 lbs. of forage, respectively, from unmanured plats.

Progress report, Substation No. 8, Lubbock, Tex., 1909 to 1914. R. E. KARPEN (*Texas Sta. Bul. 219 (1917). pp. 5-36, 39-41, figs. 7*).—This reports the results of variety and cultural tests with grain and forage sorghums, corn, Sudan grass, millet, cotton, cowpeas, peanuts, broom corn, wheat, oats, and barley; field trials of legume and nonlegume mixtures for hay, and of alfalfa, sweet clover, and beans; and soil-fertility tests with feterita and cotton. The substation is located at an altitude of approximately 3,200 ft., and for the

year period of 1912 to 1914, inclusive, had an average annual rainfall of 42.2 in., 75 per cent of which fell during the growing season, April to September, inclusive. Data for three years indicate that the average date of the last killing frost in the spring is April 8, and of the first killing frost in the fall, November 1. The experimental work reported covers the period 1912 to 1914, inclusive.

In variety tests with grain sorghums, the average yields of all varieties tested amounted to 32.06 bu. for feterita, 30.25 bu. for Kafir corn, and 28.79 bu. for milo maize. The dwarf varieties are deemed superior as indicated by average yields for 1913 and 1914 of 40.3 bu. per acre for Dwarf milo, 36.9 bu. for feterita, and 35.4 bu. for Dwarf Kafir. Spacing tests with these three crops conducted during 1914 showed average yields ranging from 30 bu. per acre for plants 6 to 7 in. apart in 36-in. rows to 57.4 bu. for spacings of 2 to 3 in. Similar tests with Dwarf milo in 1913 and 1914 resulted in average yields of 37.5 bu. for 3 to 4 in. spacings, 32.75 bu. for 5 to 6 in. spacings, and 28.7 bu. for 7 to 8 in. spacings. Feterita and milo maize grown alone in 3 and 6 ft. rows and in pairs of 3-ft. rows with 6 ft. between pairs, as compared with growing the crops with cowpeas sown in the interspaces, showed an average loss of grain of 5.6 bu. per acre and an average gain in cowpea hay of 356 lbs. per acre. It is concluded that the practice of mixed planting is not profitable for early grain sorghums in this locality.

Corn varieties grown on the substation in 1914 showed a variation in yield of from 18.5 bu. for Brown County Yellow Dent to 54.6 bu. per acre for Mexican June. The average yield of all grain sorghums tested for the period of 1912 to 1914, inclusive, amounted to 31.92 bu. per acre, as compared with 20.94 bu. for Mexican June corn for the same period.

In comparisons of Sudan grass and Tunis grass for forage, made in 1914, Sudan grass outyielded the latter in every case, showing a total average increase in yield of 0.85 ton per acre. Millet proved to be much inferior to Sudan grass. Seeded in 36-in. rows at different rates of seeding, Sudan grass produced yields of hay ranging from 3.9 tons for a seeding rate of 1.3 lbs. per acre to 4.45 tons for a rate of 6.9 lbs. Seeded in close drills, it produced 2.33 tons of hay per acre, and in 36-in. rows 2.35 tons, while for the two years 1913 and 1914 the highest average yield, 3.85 tons per acre, was obtained from plantings in 18-in. rows. In date-of-seeding tests the maximum yield for 1913, 3,542 lbs. of hay, was secured from plantings made May 15, and for 1914, 9,941 lbs., for plantings made April 10. Sudan grass grown in rows for seed produced yields ranging from 294 to 910.5 lbs. per acre.

Maximum yields of millet were obtained from seedlings in close drills, and amounted to 2,062.5 lbs. for White Proso in 1913 and 3,437.5 lbs. for Yellow Proso in 1914. German millet seeded in 36-in. rows and in close drills produced 1.5 and 1.49 tons of hay per acre, respectively. Seeded in close drills it produced 2,983 lbs. of hay per acre during 1912 and 1914, as compared with a yield of 4,855 lbs. for Sudan grass seeded in 36-in. rows.

Variety tests with 14 saccharin sorghums conducted during 1914 resulted in maximum yields of green forage of 43,780 lbs. per acre and of dry forage of 18,700 lbs. for Sumac. This variety was also highest in limited tests conducted during the period of 1912 to 1914, inclusive, with an average yield of 7,347 lbs. of dry forage per acre. Tests for seed production in 1914 resulted in maximum yields of 69.87 and 68.64 bu. per acre for Planters and Sumac, respectively. Sumac seeded in close drills at rates of 2 and 4 pk. per acre showed average yields of 7,947 and 7,675 lbs. of forage per acre, respectively.

Cowpeas and saccharin sorghums planted together in 36-in. rows and in close drills produced average yields of 5,487 and 3,084 lbs. of forage per acre, re-

spectively, while seedlings of 6:1 and 4:1 mixtures of cowpeas and sorghums resulted in average yields of 4,057 and 4,524 lbs. per acre, respectively. Rate-of-seeding tests in close drills with a 4:1 mixture resulted in average yields of 3,721 lbs. of cured forage per acre for a 60-lb. rate and 3,009 lbs. for a 30-lb. rate. For the two years 1913 and 1914, the maximum yield, 4,207 lbs. was obtained from a 60-lb. rate. Tests of various planting rates of a 4:1 mixture sown in 36-in. rows showed a maximum yield of 7,186 lbs. of forage per acre for a 19-lb. rate of seeding. A mixture of 6 parts cowpeas to 1 part Sudan grass seeded in 4, 6, and 8 pk. rates produced 3,300, 2,950, and 3,370 lbs. of cured hay per acre, respectively. Seeded alone at a 12- and 30-lb. rate, Sudan grass gave respective yields of 1,764 and 2,887 lbs. of hay per acre, but when sown with 60 lbs. of cowpeas it produced only 1,056 and 2,039 lbs. of hay per acre, respectively. It is concluded that a mixed cropping system is inadvisable, it being deemed more profitable to produce the crops separately and mix them when fed.

Burnett and Mebane Triumph, with respective yields of seed cotton of 1,199 and 980.4 lbs. per acre, were highest in cotton variety tests. In rate-of-thinning tests with two varieties during 1912 to 1914, inclusive, and with 3 varieties during 1913 and 1914, the highest yields were obtained from spacings of from 11 to 12 in. in 3-ft. rows, amounting to 883.19 and 1,399.53 lbs. of seed cotton per acre, respectively. Similar tests with 3 varieties in 1914 showed a maximum yield of 2,287 lbs. of seed cotton per acre for a spacing of 6 to 7 in. together with the highest number of bolls per pound of seed cotton, 78.4. The results, on the whole, are deemed rather inconclusive, although a stand of 12 in. apart in 3-ft. rows is regarded as satisfactory in this locality.

The highest yielding cowpea varieties were Khotan, with an average yield of 16.85 bu. per acre, and Old Bokhara, with 16.04 bu. Tests of different seeding rates of cowpeas sown in close drills for forage indicated that a rate of 6 to 7 pk. per acre was best for maximum production. Seeded in rows for forage, a rate from 18 to 20 lbs. gave the highest yield, 2,574 lbs. per acre. Average results for all methods of planting for the period of 1912 to 1914, inclusive, showed a yield of 2,949 lbs. of forage per acre for drill plantings and 2,472 lbs. for row plantings.

Peanuts are said to be successfully grown, as a rule, in this region, the Spanish variety having produced an average yield of 32.15 bu. per acre for a 3-year period.

Average yields of Tepary beans for 1912 and 1914 amounted to 17.67 bu. per acre. Navy beans and Extra Early Lima beans grown in 1914 gave yields of 5.6 and 16.73 bu. per acre, respectively.

Dwarf, Dwarf Standard, and Standard broom corn produced yields of cured, clean, stripped brush in 1912 of 198, 251, and 257 lbs. per acre, respectively, and of cured unstripped brush in 1913 of 1,622 and 2,355 lbs., respectively, for the first two varieties.

Cereal crops are regarded as rather uncertain except in seasons of abundant moisture supply, although rye, wheat, and emmer are said to make excellent winter pasture. Maximum yields in variety tests with small grains were obtained as follows: Burger, Malakof, Turkey, and Crimean winter wheats with 5.8, 5.4, 5.2, and 5 bu. per acre, respectively; Burt and Sixty-Day oats with 11.5 and 10.4 bu. per acre, respectively; Odessa and Caucasian barley with 10.25 and 9.65 bu. per acre, respectively; and rye with 10.8 bu. per acre.

Applications of 2 tons of manure per acre to feterita resulted in yields of 51.4 bu. for the manured plots and 49 bu. for the unmanured. Similar applications to cotton showed an average yield of seed cotton of 1,593.1 lbs. per acre as compared with 1,524.2 lbs. for the unmanured plots.

The identification of varieties of barley. H. V. HARRIS (*U. S. Dept. Agr. Bul. 622 (1918), pp. 32, pls. 4*).—This bulletin presents a scheme of classification of cultivated barleys, designed primarily for the use of experiment-station workers and advanced students in agronomy, and also especially to coordinate previous schemes of classification, to render available work already published on barley, to suggest modifications for obtaining a more logical arrangement of the varieties, to add four new varieties discovered during the progress of the work, and to serve as a basis for a discussion of all the agricultural varieties of barley grown upon the farms in America.

In describing species and varieties, only the major characters were used, embracing six variable factors, namely, fertility, adherence or nonadherence of the flowering glume, outer glumes, terminal appendages of the lemma, color, and density. Less important characters were utilized in describing subvarieties. Keys are presented for the identification of the four recognized species of barley, viz: *Hordeum vulgare*, *H. intermedium*, *H. distichon*, and *H. douglasii*; of 32 varieties occurring under the four species; and of the subvarieties.

An alphabetical list of rejected species, subspecies, and varieties, also of synonyms which have been published from time to time, has been prepared because "in the analysis of the relative value of the variable characters of barley, a number of variations were regarded as of too minor a nature to be used even in the description of named subvarieties. These included the elevation of the head on a short awn, awns produced on the hood itself, unaltered awns, short awns, the nature of the hairs on the rachilla, the toothing of the nerves of the lemma, and the widening of only the two outermost glumes at a node. Varieties established upon these characters are not recognized in the key." A few groups founded on characters other than those just named have been included in the list. "The most important of these is probably that of compound spikes. The inclusion of compound spikes as a recognized character would simply double the number of varieties. In barley, proliferation of spikes is common, but in most strains it is not inherited. In others, while the tendency is transmitted, it is inherited imperfectly."

Distinction between colors and variations of density are not deemed sufficiently well established to be entirely satisfactory for use in taxonomic work, and are regarded as fields for further study.

The identification of thrashed barley by means of the keys is described, and in the common agronomic varieties the chance of error is said to be negligible.

A key has also been prepared listing a few well-known agronomic varieties of barley in each of the more common subvarieties, although no attempt is made to distinguish between the agronomic varieties within a subvariety. "In the varieties at present grown in America, separations are most difficult in the lax forms of the common 6-rowed barleys. In general, there are two groups, the Manchuria-Oderbrucker and the Coast. These groups are separated by the longer, heavier grain and the more tenacious awn of the latter. Within a group such as the Manchuria, identifications must be based on combinations of minor characters, such as the density of the spike, the nature of the hairs on the rachilla, the length of grain, and, if necessary, distinctive culm characters and the length of the growing season."

A list of 41 titles is appended, comprising the literature cited.

The agricultural situation for 1918.—VIII. Corn.—A large acreage of corn needed (*U. S. Dept. Agr., Office Sec. Circ. 91 (1918), pp. 16*).—This presents a general discussion of the relative importance of the corn crop and of means for increasing the acreage and yield per acre. The employment of improved implements in preparing the land and in planting, cultivating, and harvesting the crop is recommended in addition to the use of good seed, improved cropping

conditions, and the control of insect and other enemies. The utilization of the crop for human and stock food and as a raw material for the manufacture of numerous products is noted.

Method of sale of war emergency seed corn to farmers in certain States by the United States Department of Agriculture (*U. S. Dept. Agr., Office Sec. Circ. 105 (1918), pp. 3*).—Directions are given for filing applications for seed corn by farmers in those sections of Ohio, Indiana, Michigan, Illinois, Iowa, Minnesota, Nebraska, Missouri, and Wisconsin where a shortage of viable seed is known to exist.

The seed-corn situation for 1918, W. L. BURLISON and G. H. DUNGAN (*Illinois Sta. Circ. 211 (1918), pp. 8, figs. 5*).—This describes the preparation and manipulation of the so-called rag-doll tester for seed corn, together with brief notes on the sawdust and sand box tester. Summarized data show that yields of corn from seed produced near Urbana (central Illinois) and grown at Urbana and at DeKalb (northern Illinois) have varied but little over a period of several years.

The agricultural situation for 1918.—V, Cotton.—Maintaining the supply of cotton (*U. S. Dept. Agr., Office Sec. Circ. 88 (1918), pp. 34*).—The present status of cotton production throughout the world is reviewed, and the demands placed upon the United States for cotton and its by-products are noted.

Increased production per acre by employing superior varieties, including the substitution of long-staple upland strains wherever possible, and by adopting improved methods of culture is deemed more desirable than increased acreage. The relation of disease and insect enemies to cotton growing is discussed with special reference to the appearance and measures for control of the pink boll worm.

Factors entering into the marketing of cotton with regard to a proper grading and handling of the product are outlined, and the advantages of cooperation among producers to obtain uniform lots of cotton, to build gins and oil mills, and to employ expert graders are indicated.

Gin compression of bale cotton to a density of 33 lbs. per cubic foot, or compression to a density of from 35 to 37 lbs. by high-density compression, at terminal points, is recommended as a means of materially reducing the number of freight cars required to carry the crop. It is estimated that a car holding 30 bales of uncompressed cotton would hold 65 bales of ordinary railroad-compressed cotton or 115 bales of high density compressed cotton. Furthermore, by selling cotton in the bale by net weight it is claimed that the custom of adding surplus tare to bring the tare up to the full amount allowed would be eliminated, and that 2,200 less freight cars would be required to move a 12,000,000-bale crop.

The agricultural situation for 1918.—IX, Potatoes.—An ample supply of potatoes needed (*U. S. Dept. Agr., Office Sec. Circ. 92 (1918), pp. 39, fig. 1*).—The potato is said to contribute about 13 per cent of our food material in normal times and to serve as a bread grain supplement or substitute, and for these reasons an adequate production at the present time is deemed most important. The crop of 1917, amounting to 442,536,000 bu., was the largest in the history of the country, while during the four years 1914 to 1917 the average acre yield ranged from 80.5 to 110.5 bu.

Field practices and cultural methods employed in the early-trucking regions of the South and Southwest, in the late or main crop region of the North and West, and in the irrigated regions of the West are described in considerable detail. The more important potato diseases and insect pests are noted, and appropriate control measures are outlined. The subjects of grading and marketing potatoes are also discussed.

Potato culture. T. B. HUTCHESON and T. K. WOLFE (*Virginia Sta. Bul.* 217 (1917), pp. 16, figs. 5).—This bulletin outlines cultural methods for potatoes based upon experimental work and observations made at Blacksburg on Hagerstown silt loam soil and deemed applicable to most of the soils west of the Tidewater area.

In tests of early, medium early, and late varieties of potatoes, the highest average yields for a 5-year period were obtained from Irish Cobbler with 152.06 bu. per acre, Early Rose with 170.36 bu., and Vulcan (3 year average) with 162.57 bu., respectively. Eye pieces and 0.5, 1, and 2 oz. seed pieces were employed in 3-year tests to determine the influence of size of seed piece on yield with average results of 43.93, 99.75, 148.13, and 172.53 bu. per acre, respectively. A comparison of sprouted and unsprouted seed made during 1915 and 1916 resulted in yields of 143.13 and 137.5 bu. per acre, respectively.

Potato fertilizers are briefly discussed, and notes on storage and on potato diseases and insect pests and their control are presented.

Black heart and the aeration of potatoes in storage. F. C. STEWART and A. J. MEX (*New York State Sta. Bul.* 436 (1917), pp. 321-362, pls. 101).—The accidental discovery that the exclusion of air from potatoes induced the production of black heart at temperatures much below those employed by Bartholomew (*E. S. R.* 35, p. 349) led the authors to undertake extensive investigations to determine the relation of the air supply to the occurrence of black heart, and also to determine the effect of storing potatoes in deep piles in cellars and bins and in unventilated pits and piles out-of-doors. Most of the experiments were made with sound washed and dried tubers placed in wide mouthed glass museum jars having a capacity of 3,500 to 3,700 cc., and provided with tight-fitting ground glass stoppers which were hermetically sealed. To study the effect of storing potatoes in deep piles, tall galvanized iron cylinders 9 in. in diameter and from 50 to 126 in. in height were employed. These were left open at the top, but were air-tight at the sides and bottom. One experiment was made out-of-doors with piles of potatoes protected from freezing by a covering of oat straw and soil. The temperatures varied from 2 to 24° C. (35 to 75° F.). The experiments were conducted during April and May, 1914; from January to May, 1915; and from October, 1915, to May, 1916. The Sir Walter Raleigh was used throughout the investigation. The observations are fully discussed, and form the basis for the following summarized statement of the conclusions reached:

Potatoes can not long endure close confinement. Within a certain length of time, which varied with the temperature and quantity of air available, tubers confined in hermetically sealed jars became moist over a part or the whole of their surface, and if they were then exposed to the air the moist surface areas turned brown, and the color of the flesh changed first from white to pink and then to black. With a volume of air equal to the volume of the tubers, a confinement of 10 or 12 days was sufficient to produce the symptoms described provided the temperature was around 70° F. At a temperature of 55 to 60° about 20 days were required, and at 40° from 23 to 40 days. Tubers in half full and quarter full jars behaved similarly to those in full jars, except that the symptoms were slower in making their appearance. Tubers confined in sealed jars with less than about ten times their volume of air were unable to do more than barely start sprouts. For normal sprouting about 19 volumes of air per volume of tubers were required. Black heart may be expected to appear whenever the volume of air available to the tubers is less than that required for normal sprouting.

Different tubers of the same lot exhibited marked differences in susceptibility both to black heart and to surface discoloration. The cause of this has not

been determined. It appears doubtful that the size of the tubers is an important factor.

Data obtained from the experiments with tubers in deep tanks to determine how deeply potatoes may be piled with safety were deemed insufficient for the formulation of definite rules, but it appears that 6 ft. should be considered the maximum depth of piling when potatoes are to be stored for several months at temperatures below 45°, while at temperatures above 50° the depth limit should be 3 ft. if the potatoes are to be stored longer than three or four weeks. Tubers suffering from insufficient aeration through deep piling behaved in general like tubers in sealed jars, sprouting feebly or not at all, becoming moist on the surface, discoloring externally upon exposure to the air, and often being affected with black heart internally. The principal difference was in the occurrence of rotten spots caused by fungi and bacteria.

Black heart sometimes occurred in potatoes stored out-of-doors in pits, and was due to insufficient aeration, although the experiments indicate that the aeration of potatoes in unventilated pits is better than might be supposed and that the ventilation of small pits is unnecessary.

Injury resulting from insufficient aeration was due to the lack of oxygen rather than to the accumulation of carbon dioxide.

Tubers affected with black heart produced by exposure to high temperature usually appeared normal externally, while those affected with black heart produced by exclusion of the air usually showed more or less surface discoloration.

Insufficient aeration during storage did not cause sprouting, the tubers upon being supplied with air sprouting normally if at all.

Tubers severely affected with black heart are deemed unfit for seed purposes, but slightly affected tubers may be planted. If tubers are sound and normal in appearance, it is said to be unlikely that they have been injured for seed purposes by any storage conditions to which they may have been subjected.

The prevention of black heart is a shipping problem as well as a storage problem, as the trouble often results from the overheating of potatoes during shipment in stove-heated cars.

Poor ventilation injures stored potatoes, F. H. HALL (*New York State Sta. Bul.* 436, popular ed. (1917), pp. 11, figs. 5).—A popular edition of the above.

The agricultural situation for 1918.—VI, Rice.—Produce more rice for consumption and export (*U. S. Dept. Agr., Office Sec. Circ.* 89 (1918), pp. 24, figs. 2).—The value of rice for human food is emphasized and increased consumption in the United States urged. The production of rice in this country attained a maximum of from 36,000,000 to 40,000,000 bu. during the last two years, the consumption being about 90 per cent of the amount produced. Imports declined approximately 40,000,000 lbs. during the last three years, while exports increased about 130,000,000 lbs. for the same period. The largest acreage was seeded to rice in this country in 1917 and amounted to 964,000 acres, while it is estimated that millions of acres are well adapted to growing the crop. Aside from increased acreage, means for increasing the output of rice suggested include better methods of irrigation; proper seed bed preparation, seed selection, and method, rate, and time of seeding; the judicious use of fertilizers; the proper drainage of land for harvesting the crop; careful thrashing the eradication of weeds; and the control of insects and diseases affecting the crop.

The agricultural situation for 1918.—III, Sugar.—More beet and cane sugar should be produced (*U. S. Dept. Agr., Office Sec. Circ.* 86 (1918), pp. 34, figs. 2).—Stating that the world's annual shortage of sugar since the war began has been more than 2,000,000 tons, the possibilities of increasing the

sugar supply for 1918 by curtailing consumption of refined sugar and by maintaining and, wherever possible, extending the domestic cane and beet-sugar output are fully discussed. The measures outlined may be summarized as follows: The cane sugar supply may be maintained and increased by extending cane growing to suitable lands; by better cultural methods; by adopting a rotation system that will improve the soil; by the improvement of cane varieties through selection and breeding; by the control of diseases and insects; by utilizing to the best advantage the by-products (tops, leaves, bagasse, and molasses), including a combination of live-stock production with cane growing, thus utilizing tops and leaves for feed and increasing the supply of barnyard manure; by developing and extending the cane-strap industry to provide a substitute for refined sugar and thus conserve the supply; by improving the methods of making sirup so that a better and more uniform grade will be produced and a wider and a more constant market obtained; and by producing raw sugar suitable for many household purposes.

Measures recommended for maintaining and increasing the beet sugar output include the improvement of cultural methods; proper methods of crop rotation; a proper relation between sugar plants (beet or cane) and live stock, permitting the feeding of a larger supply of by-products (tops, pulp, and molasses), and the production of a larger supply of manure; a proper relation between mill capacity and quantity of raw material produced, so that a maximum mill run will be possible; the bringing under cultivation of suitable new areas not now productive, such as certain uncultivated Indian lands in Montana, Wyoming, and Idaho; the drainage of certain wet areas otherwise capable of producing profitable crops of beets; the development of new systems of irrigation in dry areas otherwise suited to sugar-beet culture and the extension of established irrigation systems in irrigated areas where sugar-beet growing is or may be carried on profitably; increasing the beet acreage in present beet areas by inducing more farmers to grow beets; harvesting the beets more carefully, so that there will be no waste of the sugar-containing part of the beet or of its by-product; developing satisfactory seedling and harvesting machines and other beet implements that will save labor and expense in producing and handling beets; the production of an adequate supply of high-grade sugar-beet seed; and the development of strains of sugar beets that will produce a greater tonnage of beets and yield a greater percentage of sugar.

The agricultural situation for 1918.—VII. Wheat. More wheat is needed for home use and for the Allies (*U. S. Dept. Agr., Office Ser. Circ. 90 (1918), pp. 32*).—A general review of the wheat situation throughout the world with regard to acreage, production, and consumption is presented. The needs of England, France, and Italy are especially emphasized and the necessity and ability of the United States to meet these needs indicated.

The total supply of wheat for the year 1917-18 in this country is estimated to be 699,000,000 bu. and the demand of the Allies upon the United States, Australia, and India more than 200,000,000 bu. beyond that required by Brazil and neutral countries and to offset the losses by sinkings. Normal consumption in this country, said to be at the rate of 5.3 bu. per capita, would necessitate the retention of 549,000,000 bu., seed requirements of 87,000,000 bu., and stocks on hand July 1, 1918, of 40,000,000 bu. These estimates lead to the conclusion that the normal consumption must be reduced and that production must be increased in 1918.

The measures adopted for the conservation of wheat and the stimulation of production both in this country and in Europe are outlined with particular reference to winter and spring wheat acreage in the United States; the farm-labor problem; important practices in wheat growing, including selection of

soil, fertilizers, crop rotations, and preparation of the seed; the availability of seed stocks, and approved control measures for the principal insects and diseases attacking the wheat crop.

The value of rye as a substitute for wheat under certain soil and climatic conditions and possible uses of the crop are noted, and increases in rye production in the United States reviewed.

The control of wheat by the Food Administration, and the fixing of wheat prices at primary markets in 1917 and in 1918 are also noted.

Experiments with durum wheat, C. R. BALL and J. A. CLARK (*U. S. Dep. Agr. Bul. 618 (1918), pp. 64, figs. 13*).—The authors discuss the history of durum wheat in the United States, the agronomic adaptation of the crop, statistics of production, the characters and relationships which mark the durum wheat as distinct from the common wheats, and present the results of all the principal variety tests with durum wheat conducted in this country during the period 1895 to 1916, inclusive, together with the results of two experiments made in Canada.

The work comprises an assemblage of the principal accumulated experimental data from 30 field stations, many of which are here published for the first time, while some have appeared previously in publications cited. The investigations have been made cooperatively and independently by this Department and by the State experiment stations. The stations from which the data were obtained are grouped as follows: Subhumid Prairie States, including McPherson and Manhattan, Kans.; Ames, Iowa; Brookings, S. Dak.; Fargo, N. Dak.; Lincoln, Nebr.; Ashland, Wis.; and St. Paul and Crookston, Minn.; the Great Plains or semiarid area, including Hays, Kans.; Highmore, Eureka, and Newell, S. Dak.; Dickinson, Edgeley, Langdon, and Williston, N. Dak.; Moccasin, Mont.; Archer, Wyo.; Amarillo, Tex.; Akron, Colo.; North Platte, Nebr.; Brandon, Man.; and Indian Head, Sask.; and the basin and coast or arid area of the far West, including Nephi, Utah; Aberdeen, Idaho; Burns and Moro, Oreg.; and Modesto and Chico, Cal. The results obtained in the variety tests are presented in tabular form and discussed in detail, and the yields of the durum wheats are compared with those of standard common wheats grown at each station. The detailed presentation of these data are briefly summarized as follows:

For the nine stations in the subhumid prairie area, it is concluded that in general, the durum wheats are not adapted to the humid conditions often obtaining in the eastern part of this area, but they do comparatively well in the subhumid northwestern part. In the southern part of the prairie area, which includes the eastern portions of Kansas and Nebraska, neither durum nor common spring wheats do well. Wherever the hard red winter wheats of the Crimean group can be grown they greatly outyield any spring wheat. In the northeastern portion of this area, under the conditions obtaining at Ashland, Wis., and St. Paul, Minn., winter wheat is reaching the northern limits of its present culture and is not so outstandingly superior. The durum wheats are equal in yield to some of the common wheats and poorer than others. The value of the durum will depend on the quality of their grain and the need which exists for their rust resistance. In the northwestern portion of this area, including the western part of Minnesota and the eastern parts of the Dakotas, the durum wheats have a much higher comparative value. They largely outyield the spring common wheats and nearly equal winter wheat in the districts where it can be grown at all. Of the varieties of durum wheat tested Arnautka is best adapted for growing in western Minnesota and the eastern portions of the Dakotas."

The summarized results from 15 stations in the Great Plains area are thought to support the following conclusions: "Durum wheats produce very well in all

but the southern part of this large area. No spring wheats do well in the southern part of the Great Plains. Wherever the hard red winter wheats of the Crimean group can be grown commercially they are better yielders than any spring wheat. In the higher and drier parts of the plains of Colorado and Wyoming and in central South Dakota their advantage is very small. In the central and northern parts of this area, wherever spring wheat is commercially important, durum exceeds spring common wheat in yield almost without exception. Usually this is by a large margin, of 10 to 30 per cent, but occasionally by as little as 5 per cent.

"Of all the varieties of durum wheat tested in this area, the Kubanka is best adapted to all the varying conditions. It is most suitable for central and western North and South Dakota and eastern Montana, at altitudes ranging from 1,800 to 4,000 ft. The Arnautka is slightly better adapted to the more humid eastern part of the Northern Plains with altitudes ranging from 1,000 to 1,800 ft. The Pellissier is a better yielder in the western and drier sections at altitudes of 4,000 to 6,000 ft.

"A number of pure-line selections of durum wheat are proving better adapted to the local conditions where they were developed than are the older standard varieties. Three which differ appreciably from the standard varieties from which they were selected have been named. Five of these races appear to be of sufficient value to be tested under a wide range of conditions. They are as follows: Acme (C. I. No. 5284), a selection from Kubanka (C. I. No. 1516) made at Bismore, S. Dak.; Arnautka (C. I. No. 4064), a selection from Arnautka (C. I. No. 1494) made at Akron, Colo.; Monad (C. I. No. 3320), a selection made from a field in Russia but tested at Dickinson, N. Dak.; Buford (C. I. No. 5295), a selection from Taganrog (C. I. No. 1570) made at Williston, N. Dak.; Kubanka No. 8 (C. I. No. 4063), a selection from Kubanka (C. I. No. 1440) made at Dickinson, N. Dak. Of these five, Acme and Monad are very rust resistant."

A study of the data from the six stations located in the arid basin and coastal areas indicates that "except for the Crimean group of winter wheats, the standard varieties of the western areas differ from those of the Great Plains and Prairie States. In these areas the better yields have been obtained from hard red winter wheats of the Crimean group or from some variety of soft white wheat."

A bibliography of 90 titles is appended.

Cost of harvesting wheat by different methods. A. P. YERKEN and L. M. HURCH (U. S. Dept. Agr. Bul. 627 (1918), pp. 22, pls. 2).—Summarized data are presented and fully discussed regarding the present cost of harvesting wheat in the United States with binders, headers, and combines, and of shocking and stacking wheat, as compared with harvesting by hand, as formerly practiced. The observations are based on a large quantity of statistics relative to operating expenses, including man and horse labor; original cost of the apparatus; repair, interest, and depreciation charges; and the cost of twine. Various other factors entering into consideration are the topography and size of the fields, the area covered by the various pieces of apparatus studied, the character of the soil, the yield of grain and straw, the climatic conditions, etc.

"The cost of harvesting wheat at the present time varies widely in different sections of the country largely because of the different methods employed in these operations. In most cases the particular manner in which the crop is handled is influenced by climatic conditions and the requirements of the reaping system followed, as well as by the character of the wheat itself. The various methods followed throughout the country, therefore, generally are those which have been found to be well adapted to the particular conditions

existing where they are used, although local custom has in some places operated to continue systems that are more expensive than others which would be entirely practicable."

The total estimated cost of cutting one acre of wheat with a binder varied from \$0.884 for a binder with an 8-ft. cut to \$1.173 for a binder with a 6-ft. cut, each machine being drawn by 4 horses. The possibilities of reducing the cost of harvesting with a binder by the use of a small gasoline engine to operate the binder mechanism are briefly discussed. Twelve and 14 ft. headers with different sizes of crews showed a total cost of \$1.06 per acre each for 12-ft. headers with 5 men and 10 horses and for 14-ft. headers with 6 men and 12 horses, as compared with a cost of \$1.34 for 12-ft. headers with 6 men and 14 horses, and \$1.38 for 14-ft. headers with 8 men and 16 horses. In the case of the combines the maximum cost per acre was \$1.88 for the 14-ft. size employing 5 men and 24 horses, decreasing to \$1.32 for the 24-ft. size employing 6 men and 36 horses, with a minimum of \$1.10 per acre for the 7-ft. size requiring 2 men and 8 horses.

The cost of shocking estimated for various yields ranged from 16 cts. per acre for yields under 20 bu. to 26.5 cts. for yields of 31 bu. or over. The cost per acre of stacking wheat is estimated to be \$1.065 for one man pitching and one man loading; 80 cts. for 2 men pitching, with one wagon; and 88 cts. for 2 men pitching, with 2 wagons. Based on present values for man labor, it is estimated that cutting wheat with a cradle and binding and shocking by hand would cost approximately \$1.00 per acre, as compared with an average cost of \$1.23 for the modern binder, assuming a yield of 16 bu. per acre in each case.

It is concluded that the greater items of expense are for man and horse labor and depreciation of machinery. The large machines showed the smallest cost per acre, while a material saving in harvesting expense is deemed possible by a little inexpensive care of the apparatus, such as better housing, careful overhauling during the winter, etc.

The application of dockage in the marketing of wheat (*U. S. Dept. Agr. Farmers' Bul. 919 (1917), pp. 3-12, fig. 1*).—The object of this publication is to explain clearly to grain farmers and dealers the methods of determining dockage and its relation to the marketing of wheat under the United States Grain Standards Act. The equipment necessary for separating dockage is briefly described, the methods of determining and handling dockage outlined, and the value of dockage indicated. Improper applications of the dockage system are discussed, and the conclusion reached "that the majority of the objections to the assessment of dockage have arisen through misunderstandings as to the proper methods of applying dockage to the grading of wheat."

Shrinkage in grain, F. A. WELTON (*Mo. Bul. Ohio Sta., 3 (1918), No. 2, pp. 39-43*).—This reports the results of shrinkage tests with well-matured and well-damp corn, also with oats, wheat, rye, and soy beans, in an effort to determine the exact loss from shrinkage in grain held in storage.

One hundred lbs. of well-matured ear corn was placed in a wooden box on November 1, 1908, and each succeeding year for eight years, and stored in the loft of a corn crib, there being a free circulation of air about the grain at all times. The monthly shrinkage for each of the eight years was determined. The total shrinkage per year ranged from 6.5 to 26.75 per cent, with an average maximum of 20.41 per cent. With one exception (1908-09) the shrinkage increased uniformly, the maximum being attained from July 1 to September 1. Decided variations from the average were thought to be due to unusual climatic conditions during the growing season, especially excessive rainfall.

A duplicate lot of 100 lbs. of corn was kept under the same conditions as noted above, and moisture determinations made on samples of both corn and

on the first of each month. The 8-year average results showed that on November 1, immediately after shelling, the grain contained 24.91 per cent moisture and the cobs 41.51 per cent.

Damp corn was likewise stored for five years, analyses showing that on November 1 the shelled corn contained 30.29 per cent moisture and the cobs 52.1 per cent. The maximum shrinkage was attained on August 1, and amounted to 29.2 per cent. In both grades of corn the greater part of the excessive moisture was retained until after March 1, while after August 1 both grades absorbed moisture, showing an average increase of 4.17 per cent from August 1 to the date of maximum increase, which occurred the following February to April. Values of corn, equivalent to \$1 per bushel on November 1, have been computed at which the crop must be sold to avoid financial loss through shrinkage in storage. These prices attained maxima on August 1 of \$1.25 for well-matured grain and \$1.41 for damp grain.

For five consecutive years 40 bu. each of oats and wheat were weighed and stored in a bin for approximately one year, after which the contents of the bin were reweighed. Forty bu. of rye were similarly treated for a 4-year period. Increases in weight were noted in two cases each with oats and rye and in one case with wheat. On the average the oats gained 0.86 per cent moisture, while the wheat and rye lost 2.04 and 3.62 per cent, respectively. Data are presented which indicate that only slight fluctuations of the moisture content of the small grains occurred throughout the year.

Forty bu. of soy beans stored in a small bin November 2, 1911, contained 17.67 per cent moisture, and when weighed at the end of the storage period, October 23, 1912, showed a loss of 3.76 per cent.

Seed Report. (*U. S. Dept. Agr., Seed Rptr., 1 (1918), No. 5, pp. 8, fig. 1.*)—The principal feature of this number is a summary by States of the seed-corn situation based on information from various sources in an effort to show the predominating features. The States included are Illinois, Iowa, Nebraska, Missouri, Kansas, Indiana, Ohio, Minnesota, North and South Dakota, Wisconsin, Michigan, Kentucky, Tennessee, New York, Pennsylvania, Delaware, Virginia, and West Virginia. Tabulated data are presented showing the seed-corn deficiencies and surplus supplies in the first 12 States named above.

Statistical information relative to the stocks on hand and total receipts of red and alsike clover is presented, based on the War Emergency Seed Survey of January 31, 1918, and, in addition, data showing the stocks held for export as found by the Export Clover Inquiry of February 13.

The method of procedure as to approval of export shipments of corn to Canada by the War Trade Board is outlined.

The provision for war-emergency purchases and sales of seeds to farmers by this department, as authorized by the Food-production Act of August 10, 1917, is described, and its administration in the southwest, northwest, and south Plains areas is indicated. Provisions for handling the seed-corn situation are taken from another source on page 834.

Brief comments on tagging shipments of seed corn (*E. S. R., 38, p. 441*), the seed-corn situation, profiteering in seeds, and seed-corn prices are presented. Data on the imports of forage plant seed permitted entry into the United States during February are given as usual.

HORTICULTURE.

Report of the horticultural division, J. E. HIGGINS (*Hawaii Sta. Rpt. 1917, 11-23, pl. 1, fig. 1*).—Work with seedling pineapples (*E. S. R., 37, p. 142*) was continued during the year. Several thousand potted seedlings are under

observation and are to be brought to fruit under regular field conditions. Selections were made in the fields of several hundred pineapple plants to be propagated by slips or by suckers to determine the constancy of certain characters under asexual propagation. Through the cooperation of the Office of Foreign Seed and Plant Introduction of the U. S. Department of Agriculture two varieties new to the island were introduced, one, the MacGregor, from Queensland, which is said to be immune to the black heart disease; the other variety, the Commonwealth, is a seedling which has given much promise in Australia.

In connection with investigations of fruits suited to tropical conditions a co-operative vineyard of about an acre in extent was established and various fertilizer, variety, and cultural experiments are in progress. The fertilizer experiments thus far conducted indicate that phosphoric acid in liberal amounts must be applied to the type of soil used. It was found that the Japanese beetle (*Adoretus umbrosus*), one of the most important insect pests of grapes in that region, was fairly well controlled by using rather strong doses of arsenical sprays.

The principal work with avocados has been in connection with the development of a winter-ripening type with a rind sufficiently hard and tough for protection from the fruit fly and for profitable shipment. Several different avocados resulting from the crossing of an unnamed promising seedling of Guatemalan type with pollen from four varieties of West Indian avocados are under observation. Seven varieties of avocados attracting much attention in California were introduced into Hawaii during the year.

A number of mango hybrids have been produced in an attempt to combine the several good qualities of the different varieties and are being grown to fruiting. In connection with the papaya breeding investigations, it is noted that the excellence of flavor which characterized one of the original selections has now been transmitted through three generations in a large proportion of the offspring. There is also an encouraging ratio of bearing to nonbearing trees. Breeding work is being conducted with certain varieties of tomatoes in an effort to secure a strain combining sufficient size with resistance to the melon fly, *Dacus cucurbitæ*.

Notes are given on the possibilities of cacao growing in Hawaii, including a discussion of climatic and soil requirements, previous trials of cacao, and methods of cultivation.

[Horticulture at Substation No. 8, Lubbock, Tex., 1909-1914], R. E. KARPEN (*Texas Sta. Bul.* 219 (1917), pp. 36-39, figs. 2).—A brief summary of variety and adaptation tests conducted with vegetables, fruits, flowers, vines and shade and ornamental trees.

Massey's garden book for the Southern States, W. F. MASSEY (*Birmingham, Ala.: The Progressive Farmer Co.*, 1918, pp. 127, pl. 1, figs. 4).—The introductory part of this work discusses garden soil and equipment. The succeeding parts give specific information for the culture of all the common vegetables, a monthly working calendar, instructions for growing small fruits and the control of plant diseases and insects, various reference tables, and directions for lawn making.

Home vegetables and small fruits, FRANCES DUNCAN (*New York: Charles Scribner's Sons*, 1918, pp. XIV+193, pls. 8, figs. 28).—A popular treatise on the culture and preservation of home vegetables and small fruits.

Dutch market gardening and its organization, H. M. R. LEOPOLD (*Internat. Inst. Agr. [Rome], Internat. Rev. Agr. Econ.*, 8 (1917), No. 9, pp. 1-6).—A statistical account of the market garden industry in Holland. A short bibliography of cited literature is included.

The farm vegetable garden, H. O. WERNER (*North Dakota Sta. Circ. 17* 1918), pp. 64, figs. 66).—A treatise on growing, harvesting, and storing the farm vegetable supply, prepared with special reference to conditions in North Dakota. The winter forcing of plants and the starting and culture of vegetables in hotbeds and cold frames, as well as the outdoor culture of vegetables, are considered. A plan is given of a one-third acre farm vegetable garden operated at the station for three years, together with a graphic representation of dates when various vegetables are seeded, harvested, and stored or forced in order to carry out the station plan.

Disease-resistant varieties of tomatoes, S. N. GREEN and J. G. HUMBERT *Mo. Bul. Ohio Sta., 3* (1918), No. 2, pp. 43-48, figs. 3).—This paper summarizes the station work in the selection and improvement of disease-resistant strains of tomatoes.

A number of individual plant selections were made in 1911 and selections from these strains have been grown each season on the trial grounds at Wooster. Another series of selections was begun by the authors in 1915 and the work of testing the selections continued both at Marietta and at Wooster. The results of trials at Marietta in 1917, with special reference to Fusarium resistance, are presented in tabular form.

A strain of the Acme variety procured from the Louisiana Stations gave complete resistance or immunity. This strain, however, gave no greater yield than the nonresistant commercial varieties and was so late in season as to be worthless for early cropping. Two strains of the Beauty variety, the Ohio 76 and the Tennessee Station strain 10-3, gave about the same resistance, 82 and 87 per cent, respectively. The Ohio strain gave the much heavier yield and ripened its crop earlier. Selections are being made of the Bonny Best variety. The work is to be continued until commercially important strains are secured and increased for distribution.

Spray calendar, W. E. BURTON and G. P. CLINTON (*Connecticut State Sta. Bul. 199* (1918), pp. 51-98, figs. 99).—A revision of Bulletin 183 of the station (*E. S. R., 32*, p. 637). The present edition has been enlarged both as to text and illustrations.

Information for fruit growers about insecticides, spraying apparatus, and important insect pests, A. L. QUAINANCE and E. H. SIEGLER (*U. S. Dept. Agr., Farmers' Bul. 908* (1918), pp. 99, figs. 74).—This gives directions for the preparation and use of the more important insecticides necessary in combating the various insect pests of orchards, vineyards, etc., as well as other information of use in preventing or reducing insect losses to these crops. Various types of spraying apparatus, nozzles, etc., are described and illustrated, with special reference to their use in orchards and home grounds. A ready reference table for the dilutions of sprays is given, and also a chart showing what sprays may be combined and what plants treated with given sprays.

The paper concludes with a discussion of the more important insects attacking the apple, pear, quince, peach, cherry, plum, grape, currant, and gooseberry, and gives spraying schedules for the treatment of insects and diseases of the apple, peach, and grape.

Dusting v. liquid spraying, W. S. BLAIR (*Agr. Gaz. Canada, 5* (1918), No. 1, pp. 226, 227).—Tests were conducted by the Experimental Station at Kentville, Nova Scotia, in 1917 to find out the relative efficiency of sulphur dust as compared with the regular lime-sulphur spray in spraying apple trees.

Under the seasonal conditions of 1917 the dust was equally efficient a fungicide as the lime-sulphur and gave better control of cankerworm and other insects. The foliage injury was also less where the dust was used. The estimated cost of dusting one acre of trees was \$3.59 more than for spraying one

acre with lime-sulphur, but this increased cost was offset by the great advantage of reduced time in applying the dust.

Dusting v. liquid spraying in Quebec. C. E. PETCH (*Agr. Gaz. Canada* 5 (1918), No. 3, pp. 231-233, fig. 1).—These experiments comparing the value of dusting and liquid spraying as methods of applying insecticides and fungicides were performed in the demonstration orchard of the Quebec Department of Agriculture at Havelock, Quebec.

The results for the one season of 1917 indicate that dusting with sulphur and lead arsenate is fully as efficient in controlling diseases and pests as spraying with lime-sulphur and does not burn the foliage so badly. Although dusting costs more than spraying, the reduced time of application is considered to be a great advantage, especially with the present shortage of labor.

Preparation and use of lime-sulphur. J. A. STEVENSON and R. T. CORREIA (*Porto Rico Dept. Agr. Sta. Circ. 13* (1918), pp. 9, fig. 1).—Directions are given for the preparation and use of lime-sulphur with special reference to the spraying of citrus trees.

Cost of producing apples in Yakima Valley, Wash. G. H. MILLER and S. M. THOMSON (*U. S. Dept. Agr. Bul. 614* (1918), pp. 74, pls. 6, figs. 14).—This is the fourth of a series of bulletins on the cost of apple production (E. S. R. 33, p. 841). It reports a detailed study in 1915 of the current cost factors involved in the maintenance of orchards and the handling of the crop on 12 representative bearing orchards in Yakima Valley.

The total annual acre cost of producing apples for the 120 farms studied was \$345.68, or 80.02 cts. per box, figured on an average yield of 432 boxes per acre. The net labor cost was 34.49 cts. per box, or 43.11 per cent of the total net cost. Of the labor cost 17.71 per cent of the total cost was charged to maintenance and 25.4 per cent to handling. Material and fixed costs were 45.53 cts. per box, or 56.89 per cent of the total net cost. The greatest item of fixed cost was interest on investment, which made up 43.91 per cent of the cost other than labor and 24.98 per cent of the total net annual cost. The increased labor cost in cultivated orchards was offset by lower yields from orchards under the mulch-crop system, hence the total cost of production was essentially the same for both classes of orchards. Only orchards of bearing age, 7 years or older, were considered in this investigation, their average age being 12.6 years.

Of the principal commercial varieties now grown, Winesap, Jonathan, and Ben Davis make up about 43 per cent of the total acreage. Other important varieties grown are Esopus, Missouri, Yellow Newtown, Rome, Beauty, Gals, Arkansas, and Stayman Winesap.

The keeping quality of different varieties of apples. W. T. MACOUN (*Ann. Rpt. Pomol. and Fruit Growing Soc. Quebec, 1916*, pp. 82-88).—In this paper the author discusses the keeping quality of various apples under average conditions on the farm and presents the results of tests conducted for a number of years in a small room in the apple cellar at the Central Experimental Farm, Ottawa.

Growing peaches: Sites and cultural methods. H. P. GOULD (*U. S. Dept. Agr., Farmers' Bul. 917* (1918), pp. 44, figs. 27).—This is a revision and combination of the two publications formerly issued as Farmers' Bulletins 631 and 632 (E. S. R., 32, p. 338).

Gooseberries and currants. J. OSKAMP (*Indiana Sta. Bul. 207* (1917), pp. 5-11, figs. 10).—This bulletin contains suggestions relative to the culture, harvesting, and marketing of gooseberries and currants, including directions for the control of insects and diseases and a descriptive list of varieties recommended for Indiana based upon a 5-year test at the station.

Some results in raising new raspberries, C. P. NEWMAN (*Ann. Rpt. Pomol. and Fruit Growing Soc. Quebec, 1916*, pp. 114-121).—A popular account of the author's methods of breeding and raising raspberry seedlings, including some of the results secured.

The direct bearers at the National School of Agriculture, Montpellier, L. RAVAZ (*Prog. Agr. et Vit. (Ed. l'Est-Centre)*, 39 (1918), No. 10, pp. 218-221).—A table is given showing the behavior of a large number of direct-bearing hybrids with reference to the quantity of grapes and number of bunches per plant, relative immunity of foliage and fruit to mildew, period of ripening, and average weight of shoots per plant when grown both on its own roots and stock grafted.

[Report on cultural plats at the Nasinu Experimental Station, Fiji], C. H. KNOWLES (*Fiji Dept. Agr. Ann. Rpt. 1916*, pp. 2-8).—A progress report on cultural experiments with cacao, coffee, rubber, bananas, citrus, and spices.

Fig growing in Florida, H. S. ELLIOTT (*Bien. Rpt. Dept. Agr. Fla., 14 (1915-16), pt. 2*, pp. 140-148).—Popular directions are given for growing figs, with special reference to the production of fresh figs and figs for canning.

A method of feeding manure to orange trees, A. D. SHAMMEL (*Cal. Citrogr., 5 (1918), No. 6*, pp. 124, 125, figs. 4).—Observations on the Bahian method of using manure as experimentally tested in California orange groves are given.

The method here described consists essentially in burying the manure in furrows midway between the tree rows. As tested in two groves in California, this method appears to result in better tree growth than with the usual method of broadcasting manures. In one of the tests described, the manure is applied in a furrow midway between the trees running north and south one year and midway between the trees running east and west the next year.

FORESTRY.

Report of Cloquet Forest Experiment Station, W. H. KENETZ (*Minnesota Sta. Bul. 169 (1917)*, pp. 64, figs. 53).—This bulletin comprises a progress report on the various subprojects conducted at the Cloquet Station since its establishment in 1909. The methods used in the investigational work, including summarized data on some of the projects, are given.

The projects considered include studies in forestation, such as seed production, viability, and methods of extraction, nursery practice, species, methods, and seasons for artificial reforestation, ecological conditions limiting the growth and development of each species, exotics, and species not native to this region but climatically adapted; the effect of different forest stands on the accumulation and melting of snow; cutting systems for securing reproduction; methods of cutting; natural reproduction; thinnings; valuation, based on immature growth, soils suitable for forests, and other considerations; growth and yield of different species; silvicultural studies; and individual tree studies.

Annual progress report on forest administration in the Province of Bihar and Orissa for the year 1916-17, H. H. HAINES (*Ann. Rpt. Forest Admin. Bihar and Orissa, 1916-17*, pp. [64]).—The usual progress report on the constitution and management of the State forests of the Province of Bihar and Orissa, including data relative to alterations in area, forest settlements, forest surveys, working plans, forest protection, silviculture, exploitation, revenues and expenditures, etc.

Progress report on forest administration in the Northwest Frontier Province for the year 1916-17, R. PARNELL (*Rpt. Forest Admin. Northwest Frontier Prov., 1916-17*, pp. [23]+XXII).—A report similar to the above relative to the

administration of the State forests in the Northwest Frontier Province for the year 1916-17.

Progress report of forest administration in the Province of Assam for the year 1916-17. A. W. BLUNT and W. F. L. TOTTENHAM (*Rpt. Forest Admin. Assam, 1916-17*, pp. [82], pl. 1).—A report similar to the above relative to the administration of the State forests of the Western and Eastern Circles in the Province of Assam for the year 1916-17.

Annual administration report of the forest department of the Madras Presidency for the twelve months ended June 30, 1917. H. A. LATHAM, H. B. BRYANT, P. M. LUSHINGTON, and C. D. MCCARTHY (*Ann. Admin. Rpt. Forest Dept. Madras, 1917*, pp. 78+LV+13).—The usual progress report (E. S. R., 37, p. 146) relative to the administration of the State forests in the Northern, Central, Southern, and Western Circles.

Progress report of forest administration in Baluchistan for 1916-17. MULRAJ (*Rpt. Forest Admin. Baluchistan, 1916-17*, pp. 11+27).—The usual progress report (E. S. R., 37, p. 45) relative to the State forests in Baluchistan for the year 1916-17.

A practical reforestation policy. G. A. RETAN (*Jour. Forestry*, 16 (1918), No. 3, pp. 335-340).—In this paper the author examines the social and economic status of the State-owned land in Pennsylvania and offers suggestions relative to a practical policy for reforesting these lands.

The indicator significance of native vegetation in the determination of forest sites. C. F. KORSTIAN (*Plant World*, 20 (1917), No. 9, pp. 267-287).—In this paper the author reviews the related literature of the subject and presents tree growth data showing the relative productivity of two distinct western yellow pine sites with differing types of native vegetation.

The rôle of artificial regeneration in the reenforcement of hardwood woodlots. E. SECREST (*Jour. Forestry*, 16 (1918), No. 3, pp. 329-334).—In this paper the author calls attention to certain species which might prove of value in regenerating Ohio woodlots.

The relation of germination in the greenhouse and nursery. S. B. SNOW (*Jour. Forestry*, 16 (1918), No. 3, pp. 319-328).—In this paper the author summarizes the results of cutting, greenhouse, and nursery germination tests with seed of yellow pine, Jeffrey pine, and incense cedar conducted at the Feather River Experiment Station (near Quincy, Cal.) of the U. S. Forest Service.

The work so far done shows that for some species the cutting test gives an excellent index of the germinating power of the seed, while for others it is nearly worthless. With seed of yellow pine and Jeffrey pine from northern California the relations between germination in the greenhouse and the nursery to cutting-test values are remarkably consistent for all lots and for all years. The first-year greenhouse tests, running for a period of 100 days, averaged but 75 per cent of the cutting test. The corresponding nursery tests exceeded the greenhouse tests slightly and were 76 per cent of the cutting test, or just normal. There is a much wider range of variation in seed from southern California than for northern seed, and other considerations aside, the use of southern seed is undesirable because of its inconsistent behavior.

The behavior of incense cedar is extremely variable. The new seed with equal greenhouse and nursery germination averaging 40 per cent of cutting test values was the most reliable. Generally speaking, yellow and Jeffrey pines display reasonably consistent average values for number of seed per pound, relation of germination to the cutting test, and rapidity of germination, whereas such species as sugar pine, incense cedar, and firs show such great variability that average figures probably will apply only about half the time.

Aspen as a temporary forest type. F. S. BAKER (*Jour. Forestry*, 16 (1918), No. 3, pp. 294-303, figs. 3).—In this paper the author sums up the evidence showing the temporary nature of aspen in contrast to the paper by Fetherolf (E. S. R., 37, p. 837), in which aspen is considered as a permanent forest type.

Accelerated growth of balsam fir in the Adirondacks. E. F. MCCARTHY (*Jour. Forestry*, 16 (1918), No. 3, pp. 304-307, fig. 1).—The data here presented are based upon measurements made following a pulp logging operation near Brandeth Lake, N. Y. The author concludes that a crop of balsam fir, merchantable as pulp logs, can be produced in 60 years from seedlings, and that thinning will not be necessary during this period of production.

The planting of Scotch pine in Pennsylvania. J. S. ILLICK (*Forest Leaves*, 16 (1917), No. 6, pp. 87-90, pls. 4).—A discussion of the peculiarities and demands of Scotch pine (*Pinus sylvestris*), based on observations of plantings made for several years in the State forests of Pennsylvania and on the European literature of the subject.

Studies of yield and reproduction of western yellow pine in Arizona and New Mexico. G. A. PEARSON (*Jour. Forestry*, 16 (1918), No. 3, pp. 273-293).—A progress report on yield and reproduction studies which were started in 1900 and are to be continued for several years.

The data given comprise a five-year record of four "extensive" plots aggregating 1,138 acres in area. They show the increase in number of trees, condition of stands, number of dead trees and cause of death, increment, and reproduction. Factors influencing these data are also discussed. In view of the short period of observation data secured on "intensive" plots which deal with individual trees are for the most part omitted from this article.

First season's growth and mortality of white pine and red pine plantations. C. H. GUISE (*Jour. Forestry*, 16 (1918), No. 3, pp. 308-318, figs. 2).—The study reported in this paper was conducted largely on an experimental area of the department of forestry at Cornell University to determine the relative rates of height growth and root development and the mortality during the first season of planting with various grades of red pine and white pine nursery stock. The data given are for the one season, 1915.

All grades of stock commenced and ceased height growth during the same period. The better the grade of stock planted, the more satisfactory were the results as to growth and absence of mortality.

Memorandum recommending clean clearing of rubber estates in Malaya. A. SHARPLES and W. N. C. BELGRAVE (*Agr. Bul. Fed. Malay States*, 6 (1917), No. 2, pp. 88-91).—The authors present a general scheme for the treatment of pests and diseases which attack the roots of rubber trees. The recommendations herein embodied are the result of work carried out in the mycological laboratory of the Federated Malay States Department of Agriculture during 1915-16.

The production and use of fuel wood. E. SECREST (*Mo. Bul. Ohio Sta.*, 3 (1918), No. 2, pp. 49-54, figs. 2).—This paper contains information relative to the equipment and cost of producing fuel wood, together with hints on using wood for fuel and suggestions relative to woodlot improvement.

Measuring woodland products. J. B. BERRY (*Ga. State Col. Agr. Bul.*, 142 (1918), pp. 16, figs. 9).—Methods of measuring and calculating the contents of standing timber and of wood lot products are illustrated and described.

The distribution of softwood lumber in the Middle West. Pts. I, II.—**Studies of the lumber industry, VIII-IX.** O. M. BUTLER (*U. S. Dept. Agr. Rpts.*, 115 (1917), pp. 96, pls. 2, figs. 25; 116 (1918), pp. 100, figs. 25).—A study of lumber wholesaling and retailing in eleven of the Central States, including

data on costs and returns, retail and wholesale prices, lumber freights, and the division of the retail price of lumber among the various agencies concerned in its manufacture and distribution. Report 115 deals with wholesale distribution and Report 116 deals with retail distribution. The study was conducted during 1914 and 1915 in connection with the general study of conditions in the lumber industry in the United States (E. S. R., 36, p. 644; 38, p. 248).

DISEASES OF PLANTS.

Report of the division of plant pathology, C. W. CARPENTER (*Hawaii Sta. Rpt. 1917, pp. 33-42, pls. 2*).—An outline is given of work carried on by the station during the year covered by the report, the principal investigations having been on the diseases of the Irish potato and the banana.

Considerable trouble is reported with the *Fusarium* wilt disease of Irish potatoes and the late blight due to *Phytophthora infestans*. Spraying experiments for the control of late blight were conducted on a large scale, an increase of 57 per cent in yield of tubers being secured from plants given three applications of 5:5:50 Bordeaux mixture. The wilt disease due to *F. oxysporum* has been repeatedly observed, and the author suggests hill selection of seed, the discarding of such tubers as show brown discoloration at the cut stem end, and planting in new soil as the best available means of control. The mite disease of potatoes is briefly described, the trouble having been observed early in May and June. It seems very prevalent and destructive in hot weather, and is characterized by the withering and drying of the new terminal growth and that in the leaf axils. Examination of infected material has shown the constant presence of mites, but whether they are entirely responsible for the trouble or only associated with it remains to be determined.

The author reports the occurrence in Hawaii of a disease of bananas closely resembling that described by Drost (E. S. R., 27, p. 50) as due to a species of *Fusarium*. This is said to be identical with the disease described by Fawcett (E. S. R., 36, p. 352) as occurring in Porto Rico. Among other diseases of bananas, a brief description is given of the rotting before they unroll of the central leaves of the Chinese variety and the occurrence of minute gray spots which later turn black on the fruits of the same variety. The spots are said to increase in size more or less and to disfigure the fruit, rendering it unsightly and unfit for export. A *Gleosporeum* like fungus seems to be associated with this trouble.

A number of diseases on vegetables and fruits are listed.

Plant diseases, F. C. STEWART and M. F. BARRUS (*N. Y. Dept. Agr. Bul. 66 (1916), pp. 2426-2431*).—Brief notes are given on apple scab, peach leaf curl, pear blight, oat smut, stinking smut of wheat, tomato blight, bean anthracnose, and potato diseases, and on the use of powdered sulphur.

Notes on South Indian fungi, W. McRAE (*Madras Agr. Dept. Yearbook. 1917, pp. 108-111*).—A spike disease of paddy noted in the wet lands near Coimbatore and said to be caused by *Ephelis oryzae* is briefly described. In Karamadai, Coimbatore, and Pollachi, in Coimbatore District, and in Kollipatti in Tinnevely District, *Andropogon sorghum* is attacked by a fungus which changes the starch of the developing grain to sugar. In the absence of a perfect stage the fungus is called *Sphacelia sorghi*. *Haplophragmium ponderosum* is noted as having produced galls on *Acacia leucophylla* in Nellore, Chittoor, Salem, and Coimbatore districts. *McLupsora lini* has been found on the leaves of *Linum usitatissimum*, *Metampsorella ricini* on leaves of *Ricinus communis*, and *Puccinia spongiosa* on *Webera corymbosa*, all in Coimbatore. *Rhizoctonia destrucens* is reported on potatoes near Balliguda Agency, Ganjam

district, and on *Sesbania grandiflora* at Nellikuppam, South Arcot, and *R. coccinea* on *Medicago sativa* in the Salem District. On the Nilgiri Hills, *Phyllactinia corylea* (conidial stage only) was found on leaves of *Morus alba*, *Oidium citri* on *Citrus aurantium*, and *Pestalotzia funerea* on *Eucalyptus globulus*. *Uromyces curcumæ* was found on *Curcuma longa* in the districts of Kistna, Coimbatore, and Kurnool. *Collybia albuminosa*, an edible mushroom, appears each year during and after the northeast monsoon, growing from the "comb" of an *Odontotermes*.

Diseases of woody plants in North Africa. R. MADEL (*Bul. Sta. Forest. Nord Afrique*, 2 (1917), No. 5, pp. 183-186, fig. 1).—Study of a leaf spot and deformation of *Rhus oxypantha* showed the presence of a fungus which is discussed and technically described as a new species of *Exobasidium* under the name *E. hesperidum*.

Rhizopus maydis, a new species. J. BRYDERLEIN (*Bul. Soc. Bot. Genève*, 241, 9 (1917), No. 1-3, pp. 108-112).—A fungus found in corn meal is considered a new species and is technically described as *R. maydis*.

Grain smut. G. LO PRIOR (*Staz. Sper. Agr. Ital.*, 49 (1916), No. 7-8, pp. 425-451).—Referring to earlier studies by himself (*E. S. R.*, 7, pp. 224, 787) and by others, the author gives an account of his more recent investigations on *Ustilago herbarum* as to its effects on different varieties of wheat. These effects are discussed as to the alterations produced by the fungus.

Results of corn disease investigations. G. N. HOFFER and J. R. HOFFER (*Science*, n. ser., 47 (1918), No. 1210, pp. 246, 247).—A preliminary report is given of a three years' study of some little understood diseases of corn, the investigations having been made with dent corn in ear-to-row tests.

The authors have found that barren stalks and stalks which bear only nubbins appear to be correlated with certain pathological conditions in the plants. In test rows grown from ears which exhibited this pathological condition in the seedlings, 15.2 per cent were barren stalks, and 6.2 per cent of the stalks bore nubbins only, as contrasted with 6.3 per cent barren stalks and 3.4 per cent nubbin-bearing stalks where no such condition was shown.

These investigations indicate that surface-sterilized seeds may harbor bacteria and species of *Fusarium*. This is particularly true of the bacteria which cause a rotting of the seedling root tips, and this rotting is said to be characteristic of the ears of corn which develop the greatest number of barren and down stalks in the field. Controlling by hand pollination the fertilization of apparently disease-free stalks greatly reduced the number of barren stalks.

Tests made of seed in the germinator are said to have shown that all kernels from the same infested ear do not harbor pathogenic organisms, nor can the rate of seedling development usually referred to as vitality be taken as a criterion for assuming freedom from bacteria and species of *Fusarium*. The rate of seedling development in the germinator is claimed to be not indicative of the yield possibilities of that seed ear.

Greenhouse experiments on the rust resistance of oat varieties. J. H. PARKER (*U. S. Dept. Agr. Bul.* 629 (1918), pp. 16, pls. 3, figs. 2).—This paper presents results obtained in greenhouse culture work at Cornell University with the stem rust (*Puccinia graminis avenæ*) and the crown or leaf rust of oats (*P. lolii avenæ*).

Inoculations made on more than 120 strains showed 80 of these to be entirely susceptible to the rusts at both the seedling and the heading stages. Unquestionable resistance to stem rust appeared in only two varieties, White Tartarian and Ruakura Rustproof, though several varieties of red oats (*Avena sterilis*), including certain strains of Burt, Cook, Appler, Italian Rustproof, Red Rustproof, and Turkish Rustproof, are very resistant to crown rust. Resistance

to each of these rusts is claimed to be somewhat strictly specific. The evidences of resistance as described for wheat also apply to oat varieties. Early production of tella on seedling leaves probably indicates resistance.

Further search must be made for varieties resistant to stem rust, as no variety of the *A. sterilis* group has yet been found which will withstand its attacks. A basis is now offered for making selections and crosses to produce improved oat varieties resistant to crown rust and suited to conditions in different oat-growing portions of the United States.

Tylenchus tritici on wheat in Virginia, F. D. FROMME (*Phytopathology*, 7 (1917), No. 6, pp. 452, 453, fig. 2).—The author reports having received specimens of wheat attacked by *T. tritici* from a correspondent in Virginia. The presence of this nematode in wheat is said to have been noted for about six years, and the loss in a field of 10 acres due to its presence in 1917 is estimated as about 25 per cent.

Sclerotinia trifoliorum, the cause of stem rot of clovers and alfalfa, A. H. GILBERT and C. W. BENNETT (*Phytopathology*, 7 (1917), No. 6, pp. 432-442, figs. 5).—An account is given of investigations of *S. trifoliorum*, which is said to attack alfalfa, crimson clover, red clover, and white clover and to have been observed on one occasion on *Euphorbia maculata*. This fungus has long been known to attack red clover in Europe, but was first reported in this country on red and crimson clover in 1890 (E. S. R., 3, p. 689). The authors describe the disease and life history of the causal organism and give observations on its morphology, parasitism, saprophytism, etc.

The disease causes a wilting of the leaves and stems and a rotting of the stems and root systems, accompanied by the formation of black sclerotic tissue. Greenhouse experiments resulted in the production of the disease on young clover and alfalfa plants from pure cultures of the fungus.

Suggestions are given for the control of this disease, deep plowing, scattering lime over the soil, and rotation of crops being considered effective methods.

Cabbage diseases, L. L. HARTER and L. R. JONES (*U. S. Dept. Agr., Farmers' Bul.* 925 (1918), pp. 30, figs. 14).—This is a revision and extension of *Farmers' Bulletin* 488 (E. S. R., 27, p. 249).

Short smut on cholam, S. SUNDARARAMAN (*Madras Agr. Dept. Yearbook*, 1917, pp. 99-107).—The fungus (*Cintractia sorghi-vulgaris*) causing the so-called short smut on cholam (*Andropogon sorghum*) is briefly described. This is said to be the second crop, as regards acreage and importance, in the Madras Presidency, and the loss caused by the smut is very considerable.

The study here reported was intended to determine the location of infection of the host plant, the minimum effective concentration of copper sulphate solution, the effect of this concentration on germinability, and the efficiency of a copper sulphate solution of definite concentration in preventing infection in a crop. Steeping seeds in copper sulphate solution of 0.5 to 1 per cent concentration did not reduce germinability, but such reduction did follow the use of 16 per cent strength. The duration of the treatment did not markedly affect the germinability of the seeds. Strengths of 0.5 per cent and upward completely prevented the development of smut spores, untreated spores germinating freely in 24 hours. Stirring appears to be essential to complete prevention of the disease. Field tests gave similar results, and it was decided to recommend a 2 per cent solution and a 15-minute period as safe and convenient. Formalin is not considered as suitable for general use.

A Sclerotinia parasitic on Matthiola vallesiaca, A. LENDNER (*Bul. Soc. Bot. Genève*, 2. ser., 9 (1917), No. 1-3, pp. 21-29, figs. 3).—The author notes the presence of the fungus described as *S. matthiola* n. sp. on several crucifers.

are more particularly injurious to *M. ralleziaca*. The fungus is considered to be closely related to *S. panacis* and *S. libertiana*.

Wilt diseases of okra and the Verticillium wilt problem. C. W. CARPENTER (U. S. Dept. Agr., Jour. Agr. Research, 12 (1918), No. 9, pp. 529-546, pls. 12).—The author states that there are two wilt diseases of okra, caused, respectively, by *Fusarium vasinfectum* and *V. albo-atrum*, which are so similar that they can be differentiated only by isolating the causal fungi. The *Fusarium* wilt is more serious in the southern portion of the okra-growing district, while the *Verticillium* wilt is more serious in the northern portion, although the former has been found in Connecticut and the latter in South Carolina and Alabama. It is claimed that cotton may be attacked by both these fungi. *V. albo-atrum* was isolated also from the discolored vascular system of wilting plants of eggplant, potato, Abutilon, and Xanthium, causing a wilt disease in at least the first two of these. It is also known to cause a wilt disease of snapdragon. Both the fungi are readily cultivated artificially, suggesting the persistence of both in a saprophytic condition in the soil. Control measures suggested include selection of seed from healthy plants only; disinfection in formalin solution, 1:240, for two hours; and avoidance in planning rotations of all plants known to be susceptible to these fungi.

Further evidence relative to the varietal resistance of peanuts to *Sclerotium rolfsii*. J. A. McCLINTOCK (Science, n. ser., 47 (1918), No. 1263, pp. 72, 73).—In continuation of a previous report (E. S. R., 37, p. 43), the author presents additional data regarding the resistance of the variety Virginia Runner to attacks of *S. rolfsii*.

Sugar-cane fungi and diseases of Porto Rico. J. R. JOHNSON and J. A. SEVENSON (Jour. Dept. Agr. P. R., 1 (1917), No. 4, pp. 177-264, pls. 13).—In this report, which is intended to be a complete discussion of the sugar-cane fungi of Porto Rico so far as yet studied and definitely determined, technical descriptions are given of some fungus forms with some popular descriptions of diseases and causal organisms.

It is stated that sugar-cane diseases have been present and serious since 1850, and that some now present several difficult problems. Fungi found chiefly on the roots or lower stalk include *Marasmius sacchari*, *Himantia uelifera*, and *Odontia saccharicola*, all of these being more or less concerned in the so-called root disease. The principal stalk diseases include red rot (*Colletotrichum falcatum*), rind disease (*Melanconium sacchari*), and a new disease (*Cytospora sacchari*) which seriously threatens certain varieties. A number of leaf diseases are of universal occurrence, though none appear to be seriously injurious. Descriptions are given of red spot of the leaf sheath (*Cercospora vaginæ*), red rot of the leaf sheath (*Sclerotium rolfsii*), the spot (*Helminthosporium sacchari*), ring spot (*Leptosphaeria sacchari*), brown leaf spot (*Cercospora longipes*), red stripe, and wither tip. The only important disease of cane cuttings, which is that due to *Thielaviopsis paradoxa*, is readily prevented by dipping the seed in Bordeaux mixture.

A chlorotic disease occurring on the south coast is described in connection with control measures. Yellow stripe occurs in very limited areas. The new disease (as yet uncontrolled), which is characterized by a mottling of the leaves followed by a stalk canker, occurs in the western portion of the island occasioning heavy losses. Injuries due to such agencies as lightning, winds, floods, and drought are also discussed. Certain abnormalities mentioned are regarded as of little importance.

A bibliography is appended.

An epiphytotic of cane disease in Porto Rico, J. A. STEVENSON (*Phytopathology*, 7 (1917), No. 6, pp. 418-425, figs. 2).—An account is given of a disease of sugar cane which has been noted elsewhere (E. S. R., 38, p. 150).

Tobacco wildfire, F. A. WOLF and A. C. FOSTER (*U. S. Dept. Agr., Jour. Agr. Research*, 12 (1918), No. 7, pp. 449-458, pls. 2, figs. 2).—In this contribution from the North Carolina Experiment Station, the leaf spot of tobacco which has been named wildfire (E. S. R., 38, p. 150) is said to exist in 19 counties of North Carolina and in 3 of Virginia, and also to occur in Wisconsin. It is claimed to be the most destructive disease of tobacco. While the disease originated in the seed bed or plant bed, only negative evidence has been obtained to show that infection occurs through the seed. The organism (*Bacterium tabacum*), which has an incubation period of about 72 hours, forms large spots within one week on the leaves, to the parenchymal portions of which it is confined. Moisture, especially when accompanied by wind, is of prime importance in the rapid spread of the disease.

Brown rot of fruit.—Investigations in Hawke's Bay, G. ESAM (*Jour. Agr. [New Zeal.]*, 15 (1917), No. 2, pp. 84-89).—Brown rot, considered the most destructive of the many pests and diseases attacking fruits and fruit trees in New Zealand, is briefly discussed as causing severe injury in Hawke's Bay and Auckland. A brief account is given of the life history of the disease, and also of investigations. Inoculation tests are described which seem to indicate that the organism is a wound parasite.

Root knot of fruit trees, J. A. CAMPBELL (*Jour. Agr. [New Zeal.]*, 15 (1917), No. 2, pp. 63-68, figs. 5).—Root knot and associated or similar abnormalities due to *Bacterium tumefaciens*, after being almost totally suppressed in New Zealand following Government and other action, appeared again in 1915. In 1916 a serious situation became evident, this leading to investigations under the direction of the minister of agriculture.

The resulting report states that root knot and hairy root are due to the same organism. Trees from affected nurseries appearing clean when planted may develop galls after 12 months. Root knot is said to be highly detrimental to peach and raspberry, and possibly detrimental also to apple or pear.

Field experiments with crown gall, 1913-1917, H. NESS (*Texas Sta. Bul.* 211 (1917), pp. 3-21, figs. 7).—The rapid spreading of crown gall in Texas orchards is thought to have had its beginning in the extensive planting of commercial-peach orchards some 25 or 30 years ago. The climate of the Southern States is thought to be favorable to this disease, owing to its humidity and comparative freedom from frost. Absence of noticeable galls is no reliable indication of freedom from infection by the gall organism (*Bacterium tumefaciens*). Infection may occur through very slight contacts.

Tests were made with several fungicides of different strengths, and it appears that copper sulphate will prevent the occurrence of crown gall on nursery stock, if it is properly used. For sound peach trees 7 oz., and for apple trees about 1 lb., to 26 gal. of water, with an exposure of two hours in either case, are recommended. Preparation for this treatment includes the cleaning and pruning of the roots and branches and careful examining of the roots. The collar should be several inches below the surface of the disinfecting solution. The tops also should be carefully wetted with the copper solution.

Black spot of apples [and pears], W. H. TAYLOR (*Jour. Agr. [New Zeal.]*, 15 (1917), No. 2, pp. 98-100).—*Venturia inaequalis* (*Fusicladium dendriticum*) and *V. pyrina* are discussed in connection with their effects on apple and pear, respectively, and their treatments, the latter being very similar for both species and preferably preventive.

A fungoid disease attacking pears. I. W. HELMSING (*Jour. Agr. [New Zeal.], 15 (1917), No. 2, pp. 96, 97, figs. 4*).—*Entomosporium maculatum*, causing a disease resembling pear scab (*Venturia pyrina*), is briefly described as attacking readily the fruits of several varieties of pear and sometimes the young trees in the nursery, causing defoliation with a severe drain on their vitality. Peach, quince, and other orchard trees are also attacked by this fungus.

Black knot of plum and cherry. R. C. WALTON (*Mo. Bul. Ohio Sta., 3 (1918), No. 2, pp. 36-38, figs. 2*).—A popular description is given of the characteristics of the black knot of plum and cherry due to the fungus *Plowrightia morbosa*, with recommendations as to control measures.

The anthracnose disease of the raspberry and related plants. W. H. BURKS-SOLTER (*New York Cornell Sta. Bul. 395 (1917), pp. 155-183, pgs. 104*).—A marked decrease in raspberry acreage and yield occurring within the last ten years is attributed principally to several diseases, of which anthracnose is regarded as the most serious. Varietal susceptibility is not prominent within this species. The red raspberries (*Rubus idaeus* and *R. idaeus aculeatissimus*) are not very susceptible but the black raspberry (*R. occidentalis*) is very markedly so. The disease has been shown previously to be caused by *Phloeoscedella veneta*, the perfect form of *Glucosporium venetum* (E. S. R., 33, p. 350; 38, p. 252). An account is given of the life history and the geographic distribution of the fungus, the symptoms on various portions of the host, its morphology and nomenclature, its pathological histology, its cultural characters, inoculation experiments, effects of weather conditions, and control, which is aided greatly by careful selection. A review of spraying experiments is not uniformly encouraging.

Ammonium sulphid wash for American gooseberry mildew. J. V. EYRE and E. S. SALMON (*Jour. Bd. Agr. [London], 23 (1917), No. 11, pp. 1098-1100*).—This note states that an extensive series of experiments, carried out under glass and in the open air during 1916, has again demonstrated the value of ammonium sulphid as a fungicide as against powdery mildews (*Erysiphaceae*) in general, and in particular the American gooseberry mildew, the results completely corroborating the conclusions from a study previously reported (E. S. R., 35, p. 654). The present communication emphasizes the absolute necessity of including 0.5 per cent soft soap (5 lbs. to 100 gal.) in order to secure thorough wetting of the surface. Directions are given for making up an effective form of this preparation.

The supposed injury to vines by sulphurous anhydrid. A. THORNER (*Rev. Patol. Veg., 9 (1917), No. 1-2, pp. 1-24*).—A discussion is given of the data and views of several investigators regarding the alleged injury to grapevines by sulphur compounds.

Anthracnose or black spot of the vine. F. DE CASTELLA and C. C. BRITTON-BANK (*Jour. Dept. Agr. Victoria, 15 (1917), No. 7, pp. 404-421, figs. 16*).—It is stated that after being almost completely absent from vineyards in Victoria for almost 20 years, black spot has reappeared, showing in some localities unusual virulence. A discussion is given of the disease and of preventive measures.

New disease of the pineapple reported. D. B. MACKIE (*Philippine Agr. Rev. [English Ed.], 10 (1917), No. 2, p. 150, pl. 1*).—Mention is made of a disease affecting two varieties of pineapple in the Philippine archipelago. It is characterized by tissue hypertrophy, causing a rough appearance of the fruit. A heart rot of the suckers may be due to the same trouble. The disease is thought to be identical with the one which has proved troublesome in the Hawaiian Islands.

The crown canker disease of rose, L. M. MASSEY (*Phytopathology*, 7 (1917), No. 6, pp. 408-417, figs. 3).—The author reports having his attention called in September, 1916, to a hitherto unreported disease of roses grown near Philadelphia. Subsequently, plants affected with the crown canker disease were received from growers in Missouri, Pennsylvania, Indiana, Michigan, Massachusetts, and New York. Both grafted plants and those growing on their own roots are said to be affected, and it is considered questionable whether any variety is immune. From the investigation thus far carried on, the author believes that this may prove to be one of the most important diseases of roses grown under glass. So far no record of the disease on plants grown out-of-doors has been made.

Plants are affected at the crown, usually just at the surface of the soil, the lesion in advanced cases frequently extending several inches above the soil. The first indication of the disease is a slight discoloration of the bark, the color rapidly deepening to black and the tissues appearing water-soaked. Soon cracks appear in the bark, extending into the wood. Later a swelling of the stem occurs at and above the affected areas and the cracks become deeper and more evident. One very noticeable characteristic of the disease is said to be the punky consistency of the diseased tissue, especially that underground. Suckers developing from the roots of diseased plants are usually spindling and yellow and are commonly affected at the point of attachment to the main stem. Affected plants do not die quickly but yield increasingly poorer and fewer blossoms.

The crown canker disease is said to be caused by the fungus *Cylindrocladium scoparium*, and a detailed account is given of its pathogenicity, cultural characters, and moisture relations.

Experiments are said to be under way in the hope of developing some method of control for the crown canker of the rose, but at present soil sterilization and the exercise of care in using only healthy stock and scions seem to be the only feasible methods of controlling the disease.

Cronartium cerebrum on *Pinus resinosa*, J. R. WEIR and E. E. HUBERT (*Phytopathology*, 7 (1917), No. 6, pp. 450, 451).—The Norway pine (*P. resinosa*) is usually considered free from attacks of tree rusts, but the authors report infection by *C. cerebrum* on a young Norway pine tree which stood in a dense stand of *P. banksiana* heavily infected with the rust.

The significance of diseases in the economy of Malayan rubber plantations, A. SHARPLES (*Roy. Bot. Gard. Kew, Bul. Misc. Inform.*, No. 6 (1917), pp. 225-229).—A review is given of researches on fungus diseases of *Hevea brasiliensis* in Malaya. Two instances of serious attack by root diseases are cited as showing the necessity for active measures in sanitation. A practice which has been effective in the past in combating diseases was to grow more trees than are absolutely necessary in order to provide a compensatory growth to offset the ravages of root disease. Conditions for the spread of fungus diseases are said to be more favorable at the present time in Malaya than in any other rubber growing region, so that this practice is now ineffective and the menace from disease is becoming serious. The two main requirements of the present time are a physiological investigation regarding the rôle of the latex in the metabolic processes of the plant and the extent of the interference of latex extraction with the development of the tree.

Bark canker in *Hevea brasiliensis*, A. SHARPLES (*Roy. Bot. Gard. Kew, Bul. Misc. Inform.*, No. 6 (1917), pp. 219-225).—The author has collected observations on *Hevea* bark canker which have been made in various rubber growing regions. These are considered to show that the present situation is most un-

satisfactory and that the subject still requires further patient investigation before the disease can be successfully combated.

Spike disease of sandal. L. C. COLEMAN (*Dept. Agr. Mysore, Mycol. Ser. Bul.* 3 (1917), pp. IV+52, pls. 19, figs. 3).—A study of the so-called spike disease of sandal continued for several years is described in considerable detail in a report which is considered as clearing the way for further studies of this trouble, which is said to cause large and increasing losses over a considerable portion of southern India.

While the disease was not referred to any unfavorable condition in soil, climate, or association as regards its causation, it is thought that unfavorable conditions increase its virulence and transmissibility. The trouble shows itself as a profound disturbance of the ordinary functions, leading to a continuous growth of leaves and twigs, a characteristic reduction in the size of the latter, an accumulation of starch in the leaves and branches, and death of the haustoria and root ends. It is communicable by grafting, and supposedly due to an ultra-microscopical organism. Similar and similarly infectious diseases have been noted on other trees in areas where sandal grows. It is claimed that the disease may be spread by means of root connections, birds, or insects.

The effect of Roentgen and ultraviolet rays upon fungi. H. L. THOMMILL and J. W. HORSER (*Phytopathology*, 7 (1917), No. 6, pp. 426-431, figs. 2). It is stated that the museum of the University of Washington, Seattle, which served as a forestry building during the exposition conducted in 1909, was built of logs of green Douglas fir and western hemlock. These logs are said to be showing signs of decay resulting from an attack of *Fomes pinicola*. Experiments have been conducted to combat the ravages of the fungus, principally by impregnation of the wood with copper and other salts, but to avoid the difficulties of such treatment experiments were also conducted with Roentgen and ultraviolet rays to determine the possibility of destroying the fungi. Exposures were made to both kinds of rays for varying periods of time.

The results obtained do not indicate that the method employed would prove suitable for the control of such wood-destroying fungi as *F. pinicola*.

Some problems connected with the treatment of fungus diseases by spraying. E. S. SALMON and J. V. EYRE (*Rpt. Brit. Assoc. Adv. Sci.*, 86 (1916), pp. 488, 489).—This is mainly a discussion of the different avenues of approach ordinarily open to the solution of the various problems that arise in connection with economic diseases of plants, namely the fungus itself, the host, and the nature of the fungicide. Another aspect of the problem is the effect of a substance to increase the fungicidal properties of another substance, as in the case of paraffin in a spray fluid containing soluble sulphid, or of soap in liver of sulphur. Still another aspect is the question of securing intimate contact of the spray with the fungus by the addition of ingredients to lower the surface tension of the spray fluid and the measurement of such lowering.

The conduction of potassium cyanid in plants. J. A. ELLIOTT (*Phytopathology*, 7 (1917), No. 6, pp. 443-448, figs. 2).—A report is given of experiments conducted by the author with herbaceous and woody plants to determine the path of conduction of potassium cyanid through the plants and the extent of local and general injury.

It was found that potassium cyanid is conducted in the vessels and diffuses from them into the surrounding tissues, the diffusion being greatest when the conduction is slowest. Injury to the plants is said to be local, corresponding to the distribution of the potassium cyanid, except where the local injury has a secondary injurious effect on other parts of the plants. Actively growing tissues are most readily killed. In woody plants, injury is dependent on the

amount of cambium reached by the cyanid and the extent to which other parts of the plant are dependent on the injured cambium.

The wide differences in results of treatment of plants with potassium cyanid are believed to be due to slightly different manners of treatment in the different cases. Less injury is to be expected when trees are treated in the dormant state.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

Food habits of the swallows, a family of valuable native birds, F. E. L. BEAL (*U. S. Dept. Agr. Bul. #19 (1918), pp. 28, pls. 2*).—This is a report of a technical study of the food habits of 7 of the 13 species of swallows occurring within the limits of the United States, namely, the purple martin (*Progne subis*); cliff, or eaves, swallow (*Petrochelidon lunifrons*); barn swallow (*Hirundo erythrogastra*); tree, or white-bellied, swallow (*Iridoprocne bicolor*); violet-green swallow (*Tachycineta thalassina*); bank swallow (*Riparia riparia*); and rough-winged swallow (*Stelgidopteryx serripennis*). All the species are more or less gregarious and these 7 are of such wide distribution as to render their food habits a subject of economic interest.

Lists are given of the insects identified in the stomachs of the 7 species, together with the following table showing the relative proportions of the most important elements of food of the species:

Relative proportions of the most important elements of the food of swallows.

Food items.	Purple martin.	Cliff swallow.	Barn swallow.	Tree swallow.	Violet-green swallow.	Bank swallow.	Rough-winged swallow.	Average of 7 species of swallows.
	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.
Weevils.....	2.63	8.33	11.96	1.92	4.12	5.78	4.93	4.35
Other beetles.....	9.90	18.50	13.66	12.50	6.45	12.12	9.00	11.45
Ants.....	3.52	8.24	9.89	6.37	9.42	13.39	11.99	9.77
Other Hymenoptera.....	19.47	20.51	12.82	7.58	17.48	20.10	18.91	16.77
Hemiptera.....	14.58	26.32	15.10	5.59	35.96	7.96	14.99	17.37
Diptera.....	16.09	13.25	29.49	40.54	19.36	26.63	32.69	29.66
Lepidoptera.....	9.39	.46	2.39	1.07	3.12	1.21	1.11	2.29
Orthoptera.....	1.09	.71	.51	.28	.....	.01	.12	.4
Other insects.....	22.87	2.56	3.72	4.25	4.09	12.64	4.48	7.8
Other animal food.....	.46	.41	.28	.34	.....	.14	.58	1.1
Vegetable food.....	.....	.66	.18	19.46	.....	.02	.21	2.4

The crow and its relation to man, E. R. KALMBACH (*U. S. Dept. Agr. Bul. 621 (1918), pp. 92, pls. 2, figs. 3*).—This new treatise on the economic status of the crow (*E. S. R.*, 7, p. 840) discusses in detail the beneficial and harmful food habits of the crow, gives a general account of its life history and geographic distribution, and shows how it may be controlled where necessary. It is pointed out that while the misdoings with which the crow has been convicted greatly outnumber its virtues these are not necessarily equal in importance. Much of its damage to crops and poultry can be prevented while its services in the control of insect pests can ill be spared. As the capabilities of the crow for both good and harm are great, it is believed that an extermination of the species would have ultimate consequences no less serious than an overabundance.

A list of the insects and other animals and plants specifically or generically identified in the stomachs of 2,118 crows examined is included.

Diagnosis of a new pycnonotine family of Passeriformes, H. C. OGBEN HOLSER (*Jour. Wash. Acad. Sci.*, 7 (1917), No. 17, pp. 537-541).

British birds. A. THORBURN (London: Longmans, Green & Co., 1916, 2. ed., vols. 1, pp. VIII+143, pls. 20; 2, pp. VI+72, pls. 20; 3, pp. VI+87, pls. 20; 4, pp. VII+107, pls. 20).—This work contains sketches in color from life of more than 400 species of British birds, including not only resident species but also those which more or less regularly or even rarely visit the British Isles. An attempt has been made, where space permitted, to represent as many species as possible of the same family on the same plate, drawn to the same scale. A short description is given of each of the various species represented as well as notes on their distribution, nest and eggs, food, song, and habits.

The control of imported pests recently found in New Jersey. H. B. WEISS (*Jour. Econ. Ent.*, 11 (1918), No. 1, pp. 122-125).—Notes are given on the more important insects imported into New Jersey and their control.

[Insects and insect control in Oregon] (*Proc. Wash. State Hort. Assoc.*, 13 (1917), pp. 99-104, 108-124).—The several papers relating to insects and their control, here presented, include the following: Codling Moth (Conditions of 1916, by R. E. Trumble (pp. 99-104); Spraying Apple Orchards, with Special Reference to Aphis Control, by S. W. Foster (pp. 108-111); Nicotin Sulphate in Codling Moth Control, by F. E. De Sellem (pp. 111-121) (E. S. R., 38, p. 653); and The Strawberry Root Weevil, by A. L. Melander (pp. 121-124), noted on page 864.

Report of the Dominion entomologist for the year ended March 31, 1917. C. G. HEWITT (*Canada Dept. Agr., Rpt. Dominion Ent., 1917*, pp. 24). This is the usual brief statement of the work of the year (E. S. R., 38, p. 556). An index to the subject matter is included.

Insect pests [in Grenada]. F. WATTS (*Imp. Dept. Agr. West Indies, Rpt. Agr. Dept. Grenada, 1916-17*, pp. 12, 13).—A brief report on the more important insect pests of the year.

[Economic insects of Japan] (In *A Collection of Essays for Mr. Yasushi Nawa*, [etc.], edited by K. Nagano. Gifu, Japan; Naica Ent. Lab., 1917, pp. 1-65, pls. 8, figs. 10).—Among the papers included in this collection of essays written in commemoration of the sixtieth birthday of Y. Nawa are A New Genus of Bark Beetles [Orosiotes], by Y. Nilsima (pp. 1-4); Two Species of Termites from Foochow, China, by M. Oshima (pp. 5-7); Three New Species of Trichosiphum in Formosa, by M. Maki (pp. 9-22); Notes on Some Lepidoptera Heterocera of Japan, with Descriptions of Two New Genera [Margaronia and Hirayamaia] and Four New Species, by N. Marumo (pp. 23-37); and Synopsis of the Pemphigidae of Japan, by S. Matsumura (pp. 39-94). Twenty-nine species of aphids of the family Pemphigidae representing 19 genera are recognized as occurring in Japan, of which 20 species and 7 genera (Mansakia, Nurudea, Nurudeopsis, Fushia, Gobalshia, Watabura, and Nishiyana) are described as new to science.

War on greenhouse pests. H. A. GOSSARD (*Mo. Bul. Ohio Sta.*, 3 (1918), No. 1, pp. 55-61, figs. 4).—A popular account in continuation of that previously noted (E. S. R., 38, p. 762).

Important foreign insect pests collected on imported nursery stock in 1917. E. R. SASSER (*Jour. Econ. Ent.*, 11 (1918), No. 1, pp. 125-129).—This is a summary of information on the insects intercepted during 1917 in the course of State and Federal inspection work.

Notes on insects injurious to coffee. T. J. ANDERSON (*Dept. Agr. Brit. East Africa Bul.*, 2 (1917), pp. 20-43).—This consists of brief notes on the more important insects of coffee, with a discussion of control measures.

Insects and camp sanitation. E. P. FELT (*Jour. Econ. Ent.*, 11 (1918), No. 1, pp. 93-106).—A general discussion of the subject on which a more extended account by the author has been previously noted (E. S. R., 37, p. 760).

A method of graphically illustrating the distribution of injury by an insect pest, F. Z. HARTZELL (*Jour. Econ. Ent.*, 11 (1918), No. 1, pp. 32-39, figs. 2).—The method devised by the author is described, the grape flea-beetle being used in giving a practical explanation of its application.

Toxicity of volatile organic compounds to insect eggs, W. MOORE and S. A. GRAHAM (*U. S. Dept. Agr., Jour. Agr. Research*, 12 (1918), No. 9, pp. 579-587).—Investigations conducted at the Minnesota Experiment Station, here reported, are summarized by the authors as follows:

"In general compounds with high boiling point and slight volatility are more effective in dipping and spraying insect eggs than compounds with low boiling point and high volatility. Compounds with low boiling points kill freshly laid eggs more readily than eggs in which the embryo is partially or fully developed. Compounds of higher boiling points are more toxic to eggs with fully developed embryos than they are to eggs in which the embryo is only slightly formed. Kerosene containing both high and low boiling points is destructive to both young and old, but is only slightly toxic to partially developed eggs. The toxicity of the vapor of organic compounds to insect eggs is related to the boiling point and the volatility. As the boiling point increases and the volatility decreases the toxicity increases."

A list of 10 references to the literature is appended.

The influence of molasses on the adhesiveness of arsenate of lead, F. Z. HARTZELL (*Jour. Econ. Ent.*, 11 (1918), No. 1, pp. 62-66).—In reporting upon the results of adhesive tests it is stated that the success which attended earlier experiments was probably due to the lack of rain immediately following the application of the spray mixture containing molasses. In field work excellent results have been secured from the use of molasses and arsenate of lead in the control of the grape root-worm through studying the weather conditions and applying the spray at a time when there is little probability of rain, and by following the first spraying in about one week with an application of Bordeaux mixture and lead arsenate to act as a repellent to invading beetles which might enter the vineyard during the dispersion period. It is recommended that the weather conditions be observed and the molasses and arsenate of lead mixture applied at a time when freedom from rain is to be expected for at least three or four days.

Spreaders for arsenate sprays, A. L. LOVETT (*Jour. Econ. Ent.*, 11 (1918), No. 1, pp. 66-69).—In preliminary tests at the Oregon Experiment Station sea-tea and a casein lime mixture gave the least burn and approximated the ideal sought for in a spreader.

Appearance of the male *Carausius morosus* and its longevity, G. FOURCHU (*Compt. Rend. Acad. Sci. [Paris]*, 165 (1917), No. 16, pp. 511-513).—This paper relates to an orthopteran which is a remarkable example of parthenogenicity.

The eggplant lace bug in Porto Rico (*Corythucha monacha*), R. T. CORNER (*Jour. Dept. Agr. P. R.*, 1 (1917), No. 3, pp. 170-173).—An account of studies of *C. monacha*, which is the worst of the many insect pests of the eggplant in Porto Rico.

A key to the species of the genus *Ceresa* occurring north of Mexico and the description of a new species, E. H. GIBSON and EMMA WELLS (*Bul. Brooklyn Ent. Soc.*, 12 (1917), No. 5, pp. 110-113).—A key is given for the separation of 17 species of membracids of the genus *Ceresa*, known to occur north of Mexico, of which the species *Ceresa militaris* from Missouri is described as new.

Notes on three species of apple leaf-hoppers, F. H. LATHROP (*Jour. Econ. Ent.*, 11 (1918), No. 1, pp. 144-148, figs. 3).—This is a brief report of observations at the New York State Experiment Station on the life history and habits

of three important leaf-hoppers attacking apple, *Empoasca mali*, *E. unicolor*, and *Empoa rosæ*.

During the summer and fall of 1915 there was a heavy infestation in the district of western New York about Geneva of *E. mali* and *E. rosæ* was quite common. Their attacks were in evidence in all orchards observed, whereas *E. unicolor* was comparatively rare and no cases of heavy infestation were observed. During the following season, which was fully two weeks later than normal, *E. mali*, though decidedly injurious, was less in evidence than during the preceding season, while *E. unicolor* was exceedingly plentiful, proving to be a true pest and by far outnumbering *E. mali*. *E. rosæ* was again prevalent in 1916, and in spite of its natural enemies did considerable injury.

On apple *E. mali* feeds almost exclusively on the tender terminal growth and shows a marked preference for young, growing trees. *E. rosæ* and *E. unicolor* both largely attack the older leaves, but occur on both old and young trees. *E. mali* causes a severe and characteristic curling of the foliage and resultant injury to the trees. Further experiments must be conducted before any conclusion can be drawn as to their transmission of fire blight.

E. rosæ and *E. unicolor* pass the winter in the egg stage, while *E. mali* hibernates largely if not exclusively in the adult stage.

A graph is given showing the life cycles of the three species as observed at Geneva during the two seasons.

Texas aphid notes, F. B. PADDOCK (*Jour. Econ. Ent.*, 11 (1918), No. 1, pp. 25-32).—A brief review of observations of plant lice in Texas that have been recorded by the author and others.

A simple means of ascertaining if a sterilizing hut is hot enough to destroy lice and nits in clothing or blankets, A. BACOR (*Brit. Med. Jour.*, No. 253 (1917), p. 151).—The author has found that stearin, which melts at 60° C. (140° F.), is a satisfactory indicator as to the amount of heat and length of time required for destroying lice and nits in clothing and blankets, nits protected by a single thickness of khaki cloth being killed by 15 minutes' exposure to a temperature of 52°. Seven gm. of stearin in a porcelain pot 2.5 in. deep and 2.5 in. in diameter requires 30 minutes to melt, a small portion being still unmelted after 25 minutes; 10 gm. requires between 40 and 50 minutes for melting, only a narrow ring being melted within 30 minutes.

"If two pots, one containing 7 gm. and the other containing 10 gm., are placed or hung slightly below the level of the lowest garments in the sterilizing room, one can be sure, if all the stearin in the 7 gm. pot is melted before the removal of the garments, that the exposure has been sufficient, both as regards period and heat; while, if all the stearin is melted in the pot containing 10 gm., it will show that greater heat or longer exposure than was necessary has been used. . . .

"Nits and stearin were exposed together, and it was found that the stearin was more resistant to these conditions than the nits. For instance, when the temperature was rapidly raised from 21 to 80° within 20 minutes, the nits were killed, while the 7 gm. of stearin was not quite all melted. A rise to the same temperature in 18 minutes showed the same result. A rise to 82° in 15 minutes was just sufficient to melt all the stearin, the nits being killed. Again, a rise in 12 minutes to 81° killed the nits, but left a central disk of stearin unmelted."

Annual reports of the Royal Sericultural Station, Padua, E. VERNON ET AL. (*Ann. R. Staz. Bocol. Padova*, 39-40 (1911), pp. 282, pl. 1, figs. 3; 41 (1914), pp. 207, pls. 4; 42 (1915-16), pp. 185, pls. 3, figs. 13).—These are the usual reports (E. S. R., 25, p. 662) dealing with sericultural investigations. Each includes a list of publications relating to the subject that were issued during the period covered.

The use of phototaxy in selecting from the moment of their birth those larvæ of *Bombyx mori* most resistant to the disease flacherie, C. ACQUA (Abs. in *Internat. Inst. Agr. [Rome], Internat. Rev. Sci. and Pract. Agr.*, 4 (1917), No. 6, pp. 910-912).—During investigations carried out to determine the action of light on the movements of *B. mori* the author found that the newly-hatched larvæ immediately turn to the source of light and that this movement diminishes during the following days and disappears entirely at the end of the first stage. During the subsequent stages there is an inverse but less energetic movement and the larvæ tend to avoid the light. The larvæ which were most resistant to flacherie were those which from the time of their birth had traveled farthest.

Gipsy moth larvæ as agents in the dissemination of the white-pine blister rust, G. F. GRAVATT and G. B. POSEY (*U. S. Dept. Agr., Jour. Agr. Research*, 12 (1918), No. 7, pp. 459-462).—The investigations here reported, which were conducted in 1917 at Kittery Point, Me., with the view of determining the relation of gipsy moth larvæ to the dissemination of the spores of the causal organism of white-pine blister rust (*Cronartium ribicola*), have been summarized as follows:

"The period of hatching and of wind dissemination of gipsy moth larvæ came within the period of spore production of the blister rust on pines. Larvæ fed abundantly on spores and injured the fruiting layer of the pustules so that further spore production was arrested. Larvæ from blister rust cankers had thousands of viable spores on their bodies. A small percentage of the larvæ collected from fly paper and from species of *Ribes* near infected pines showed æciospores on their bodies. Gipsy moth larvæ were found feeding on leaves of *Ribes* spp., and in some cases the only infected leaves on plants of this genus were those showing insect injury. The Bureau of Entomology has shown (E. S. R., 37, p. 254) that these larvæ are blown by the wind up to a distance of 20 miles. Within this distance the larvæ are potential agents in the spread of the white-pine blister rust (within the area infested by the gipsy moth)."

The apple ermine moth, P. J. PARROTT (*Jour. Econ. Ent.*, 11 (1918), No. 1, pp. 55, 56).—In an earlier report from the New York State Experiment Station (E. S. R., 23, p. 657) the author dealt with the cherry ermine moth (*Epomoeuta padellus*) which was imported on cherry seedlings. An associated species, the apple ermine moth (*E. malinella*), has since been observed in New York on apple, and in the present paper notes on its identity and distribution in nurseries are presented. Since 1910 it has been discovered each year in plantings of foreign stock in New York, but has not been reported from outside the State, except in New Brunswick. Whether the two forms represent distinct species or are only varieties of the same species remains to be determined.

The imported cabbage worm in Wisconsin, H. F. WILSON and L. G. GUTNER (*Jour. Econ. Ent.*, 11 (1918), No. 1, pp. 79-81, pls. 2).—"While Paris green gives efficient control the cost is too high for economical use. Lead arsenate and calcium arsenate at the rate of 1 lb. of the powder or 2 lbs. of the paste to 50 gal., with the addition of 1 lb. or more of common laundry soap, give efficient control and are the most economical to use. The failure of zinc arsenite to control the cabbage worm is not understood and further experiments will be made. No trace of arsenic was found to be present on sprayed heads prepared for cooking even when sprayed as late as a week before picking. The outer leaves may carry enough arsenic to poison stock and are therefore dangerous to use for that purpose."

Nicotin sulphate an effective ovicide for codling moth eggs, A. L. LOVETT (*Jour. Econ. Ent.*, 11 (1918), No. 1, pp. 149, 150).—The author first refers to

the successful results obtained by De Sellem at North Yakima, Wash., in the control of the codling moth through the use of nicotin sulphate (E. S. R., 33, p. 653). See also abstract noted on page 857. Experiments conducted by the author and briefly reported upon show that nicotin sulphate is an effective pesticide for codling moth eggs and that the addition of soap renders it practically perfect in this regard.

Some experiments on the adults and eggs of the peach tree borer, *Sannioidea exitiosa*, and other notes, A. PETERSON (*Jour. Econ. Ent.*, 11 (1918), No. 1, pp. 46-55, figs. 2).—This is a report of studies at the New Jersey Experiment Stations, particularly of control measures, made during the summer of 1917, near Clementon, N. J., in a heavily infested 80-acre orchard of seven- to eight-year old peach trees of different varieties.

Data relating to the repellent effect of various sprays during oviposition, the effect of sprays on eggs, etc., are reported in tabular form. The results obtained indicate the improbability of developing a poison bait for the adult, the partial repellent effect of certain chemicals on the female while ovipositing, and the partial destruction of eggs when certain substances are applied as a spray. While experiments* under way on the use of various chemical and mechanical tree protectors do not as yet warrant a statement, the author is of the opinion that the peach borer trouble will be solved through the finding of some mechanical or chemical barrier that will prevent its gaining entrance or will kill the larva before it enters the tree.

The striped peach worm, H. G. INGERSON (*U. S. Dept. Agr. Bul.* 599 (1918), pp. 14, pls. 4).—This is a report of biological and control investigations of *Gelechia confusella* (*Depressaria persicælla*) conducted during 1915 and 1916 in Michigan at Benton Harbor, the only State in which the species is known to occur.

This lepidopteran, first described by Chambers in 1875 from an unknown locality, has received but little notice as an economic species. While not at present a major pest of peach, it has been observed feeding on sand cherry (*Prunus pumila*), its only other plant host, in such numbers as to web nearly every terminal and partially defoliate it, thus indicating a possibility of extensive injury to peach orchards. The larvæ feed either singly or gregariously on both host plants and though not voracious feeders include in their webs much foliage that is not used as food. Their webbing commences directly after hatching, even before they feed, which takes place next to the midribs of the leaves, small irregular holes first being eaten through the parenchyma and later either or both leaf surfaces being skeletonized. The injury to the peach is caused by the feeding of the larvæ on the foliage. The webs which they spin are loose and often very conspicuous, but the leaves included in the webs soon become dry and cease to function.

At Benton Harbor there was one full brood and a partial second, the earliest emergence of moths in 1916 taking place May 22, and emergence being quite regular from June 5 to July 14. Moths placed in jars with peach foliage and fruit deposited eggs both on the fruit and under the scales surrounding the attachment of the peach to the stem. In observations of 118 eggs the period of incubation varied from 10 to 19 days, with an average of 13.18 days. The feeding period of the transforming first brood larvæ reared in cages varied from 22 to 36 days, with an average of 29.6 days for transformation; of wintering first brood larvæ, 22 to 48 days, with an average of 34.2 days. The cocoons of the first brood are formed in the soil at an average depth of 0.5 in. The average length of the period in the cocoon was 12.4 days, the longest period 21 days, and the shortest 9 days. The first brood moths were emerging in 1915,

from August 4 until September 12, with the largest number on August 19. From 683 larvæ collected on sand cherry on July 28, only two moths subsequently emerged during the season, one on August 28 and the other on September 9. Oviposition of the first brood moths took place in 1915, from August 15 to 19. The second brood eggs began to hatch in 1915 on August 31, and continued to hatch until September 3, the average incubation period being 15.6 days. The larvæ were observed feeding from August 23 to November 14, the maximum length of the feeding period being 74 days, the minimum 39 days, and the average 52.1 days. While cocooning normally takes place in the soil, 13 of 361 individuals recorded pupated in the webbed foliage in which they had lived as larvæ.

A number of parasites were reared, including four ichneumonids, namely, *Angitia discoocellella*, *Cremastus forbesii*, *Cremastus* sp., and *Epirus indigator*; three braconids, *Apanteles gelechiæ*, *Ascogaster carpocapsæ*, and *Epirhyssalus atriceps*; two tachinids, *Exorista pyste* and *Frontina ancilla*; and one bombyliid, *Anthrax lateralis*.

In spraying experiments where arsenate of lead powder at the rate of 1 lb. to 50 gal. of water was employed 5 per cent of the terminals were webbed, whereas used at the rate of 1.5 lbs. to 50 gal. of water, 3 per cent were webbed, whereas with the unsprayed checks 90 per cent were webbed. It is suggested that the occurrence of this pest may be so local as to be remedied by cutting out the infested terminals or branches, and that it will probably not occur in damaging numbers in orchards sprayed regularly with arsenicals for control of the plum curculio.

Notes on the strawberry leaf-roller (*Ancylis comptana*), R. L. WEBSTER (*Jour. Econ. Ent.*, 11 (1918), No. 1, pp. 42-46).—This paper consists of brief notes on the biology of the strawberry leaf-roller, a more complete account of which is being issued in bulletin form.

Notes on the biology of the Angoumois grain moth, *Sitotroga cerealella*. J. L. KING (*Jour. Econ. Ent.*, 11 (1918), No. 1, pp. 87-93, figs. 2).—This is a report of biological studies at a field station located at York, Pa., in the southeastern part of the State. In this section the wheat production is about one-third of the total grown in the State, and it suffers an aggregate annual loss from insect injury of over a million dollars. A diagram is given which shows the appearance of the several broods during the year. It is pointed out that the practice of storing unthrashed wheat in the mow is responsible for much of the loss, and the importance of thrashing as soon after harvesting as possible and storing the grain in tight granaries or in good sacks is emphasized.

The apple leaf-mining case bearer (*Coleophora volckei* n. sp.) W. H. VOLCK (*Mo. Bul. Com. Hort. Cal.*, 6 (1917), No. 11-12, pp. 463-467, figs. 6).—These notes relate to the life history and habits of a new tortricid to be described by Heinrich under the name of *Coleophora volckei*. Its injury, which consists of one or more small punctures in the skin extending a short distance into the pulp, has been more or less in evidence on Pajaro Valley apples at harvest time for several years past. General observations indicate that nicotine sulphate is capable of a very marked control of *C. volckei*, but that the control of the codling moth or fruit-tree leaf-roller is not so good as with arsenicals.

Malaria control.—A report of demonstration studies conducted in urban and rural sections, R. C. DERIVAUX, H. A. TAYLOR, and T. D. HAAS (*Pub. Health Serv. U. S., Pub. Health Bul.* 88 (1917), pp. 57, pls. 17, figs. 7).—A report of demonstration studies in malaria control conducted by the Public Health Service in cooperation with the International Health Board during 1916 in two highly endemic localities in southeastern Arkansas.

Relation of kinds and varieties of grain to Hessian fly injury. J. W. McCULLOCH and S. C. SALMON (U. S. Dept. Agr., Jour. Agr. Research, 12 (1918), No. 8, pp. 519-527).—This is a preliminary report of investigations conducted at the Kansas Experiment Station.

The authors find that the Hessian fly is able to discriminate between different kinds and varieties of grain. "Eggs were laid on all the kinds and varieties of grain studied, but very sparingly on winter oats, winter barley, elkorn, spring emmer, spelt, and durum spring wheat. On the average, fewer eggs were laid on soft winter wheat than on hard red winter wheat, but exceptions in both cases were found. There appeared to be a large mortality of eggs or larvae on all kinds and varieties studied. This appeared to be greatest for rye, elkorn, spring emmer, winter oats, and Illini Chief wheat. Very few fly-eggs were found on winter barley, and on Beechwood Hybrid, Currell Selection, and Dawson Golden Chaff wheats."

Early spring Syrphids in California and a new Pipiza. W. M. DAVIDSON (Ent. News, 28 (1917), No. 9, pp. 414-419, fig. 1).—In addition to observations on the occurrence of syrphids in spring, the author describes a new species under the name *Pipiza californica*. The larva of this species is aphidophagous, having been found to feed upon the sexes of *Pemphigus populicaudæ*.

Poisoned bait for the onion maggot. N. F. HOWARD (Jour. Econ. Ent., 11 (1918), No. 1, pp. 82-87, pls. 2).—This is a report of investigations carried on by the Bureau of Entomology of the U. S. Department of Agriculture in Wisconsin in continuation of those previously noted at the Wisconsin Experiment station by Sanders (E. S. R., 33, p. 357) and by H. H. P. and H. C. Severin (E. S. R., 34, p. 360). The results obtained have led to the following summary: "For two seasons the poisoned bait for the onion fly has given decidedly negative results. Failure was due, to a great degree, at least, to adverse climatic conditions. These conditions are normal to this section of the country, however, and to other onion-growing districts. In sections where the onion fly occurs and where climatic conditions are more favorable to poisoned bait applications, further trial is strongly recommended."

***Meigenia floralis*, a parasite of the black alfalfa-leaf beetle (*Colaspidea atrum*).** LÉCAILLON (Compt. Rend. Acad. Agr. France, 3 (1917), No. 30, pp. 881-885).—This tachinid (*M. floralis*), a parasite of the asparagus beetle, each year destroys large numbers of the chrysomelid beetle *C. atrum*.

Control of the common white grub. R. T. CORROX (Porto Rico Dept. Agr. Sic. Circ. 12 (1918), pp. 7, figs. 2; Spanish Ed., pp. 7, figs. 2).—A brief summary of information relative to the control of *Phyllophaga vandinæ* and *P. portoricensis*, an account of which by Smyth has been previously noted (E. S. R., 33, p. 767). Collecting the white grubs and the beetles is said to be the best method of control now known.

Studies on the life history of two Kansas Scarabæidæ. W. P. HAYES (Jour. Econ. Ent., 11 (1918), No. 1, pp. 136-144).—This is a report of morphological and biological studies at the Kansas Experiment Station of two white grubs, *Erytrocera villosa* and *Anomala binotata*.

The life cycle of *C. villosa* is one year. Adults appear at lights in June, July, and early August. Eggs, which are laid in soil, hatch in from 9 to 25 days. The winter is passed in the larval stage, which stage was found to average 347 days. The pupal stage varied in length from 8 to 24 days.

The adults of *A. binotata* are injurious to fruit-producing plants, and the grubs are minor pests of corn, wheat, and oats. The winter is passed in the adult stage. Eggs are laid in the spring and soon hatch, producing larvae whose average time of development was found to be 83 days. The pupal

stage lasts on an average 16 days. The adults transform in the fall and remain in their pupal cells until the following spring, thus completing a one-year life cycle.

Lists of references to the literature on the two species are included.

Notes on the habits and metamorphosis of *Lepidiota frenchi*, E. JARVIS (*Bur. Sugar Expt. Stas. Queensland, Div. Ent. Bul. 5 (1917), pp. 14, figs. 29*).—This beetle is said to rank second to the gray-back cockchafer in economic importance among the scarabæids affecting sugar cane in Northern Queensland. It feeds habitually on the roots of native cereals and other herbaceous plants and has acquired a liking for cane.

Insecticide tests with *Diabrotica vittata*, N. F. HOWARD (*Jour. Econ. Ent. 11 (1918), No. 1, pp. 75-79*).—In tests in 1916 at Madison, Wis., of Bordeaux mixture (2:4:50) and lead arsenate paste (4:50) combined, against the spotted cucumber beetle the efficiency of the spray was about 25 per cent. The average efficiency of insecticides, based upon two seasons' results, is as follows: Zinc arsenite 24 per cent, lead arsenate 17, sweetened lead arsenate 17, Paris green 16, zinc arsenate 14, Bordeaux-lead arsenate 14, lead arsenate dust 9, cobalt arsenate 4, calcium arsenate 1, and arsenic bisulphid 0 per cent.

Life history of *Haltica jamaicensis*, R. T. COTTON (*Jour. Dept. Agr. P. R. 1 (1917), No. 3, pp. 173-175*).—An account of the largest of the flea-beetles found in Porto Rico, which at times is extremely abundant. Though it now confines its attention to weeds of the genus *Jussiaea*, it occasionally feeds on garden beans.

Sweet potato root borer (*Cylas formicarius*), W. E. HINDS (*Alabama Col. Sta. Circ. 37 (1918), pp. 3-8, figs. 9*).—This circular, which is intended primarily as a warning against the sweet potato root borer, gives a brief summary of information regarding it. Quarantine against the pest is announced by the Alabama State Board of Horticulture and the rules and regulations relating thereto are presented.

Weevils which affect Irish potato, sweet potato, and yam, W. D. PIERCE (*U. S. Dept. Agr., Jour. Agr. Research, 12 (1918), No. 9, pp. 601-611, pls. 7*).—Notes are first presented on three important Andean weevil pests which affect Irish potato tubers, namely, *Rhigopsidius tucumanus*, *Premnotrypes solani*, and *Trypophremnon latithorax*, descriptions of which have been previously noted (*E. S. R.*, 30, p. 459), and a table for the identification of Irish potato tuber weevils in the field is also given. A description of the larva of *T. latithorax* follows, and a fourth potato tuber weevil from Cuzco, Peru, *T. sanfordi*, is described as new to science.

Four species of weevils are described as attacking the tubers of the sweet potato (*Ipomœa batatas*), namely, the sweet potato weevil (*Cylas formicarius*), *C. turcipennis*, *C. femoralis*, and the scarabee (*Euscepes batatae*), the first-mentioned being the only one of the four to occur in the United States, though *E. batatae* occurs in the West Indies, including Porto Rico, and in Hawaii, Guam, and Brazil. A weevil which attacks the tubers of yams (*Dioscorea batatas*) in Jamaica is described as new under the name *Palæopus dioscoreæ*.

The strawberry root weevil, A. L. MELANDER (*Proc. Wash. State Hort. Assoc., 13 (1917), pp. 121-124; Better Fruit, 12 (1918), No. 11, pp. 7, 8; also in Rev. Appl. Ent., Ser. A, 5 (1917), No. 12, p. 579*).—This is an account of the strawberry root weevil (*Otiorynchus ovatus*), which was introduced from Europe some 50 years ago and which now occurs in the Northern States and is particularly injurious in British Columbia. The pest first appeared in Washington State in 1904 and has now invaded the principal berry regions of the State. Studies of the pest in British Columbia by Treherne have been previously noted (*E. S. R.*, 37, p. 568).

In control work good results were obtained with carbon bisulphid. The infested parts of rows were covered with a 30 ft. strip of canvas or cloth sheeting made gas-tight by painting with linseed oil, under which at intervals of 5 ft. saucers, each containing $\frac{1}{2}$ oz. of carbon bisulphid, were placed. When necessary, the canvas was raised above the saucers by wooden props to allow of free evaporation and made air-tight at the edges by earth shoveled on it. The fumes penetrate the soil to the depth of several inches and kill the adults, larvæ, and pupæ, as well as wireworms, tipulids, and other insects. It is best applied during the few days after the crop is gathered, before migration and egg-laying begin.

The agricultural situation for 1918.—IV, Honey.—More honey needed (U. S. Dept. Agr., Off. Sec. Circ. 87 (1918), pp. 8).—Attention is called to the importance of enlarging the number of colonies of bees wherever possible. The opportunity for expansion of beekeeping is pointed out and the factors in successful beekeeping briefly considered.

Rearing queen bees in Porto Rico, R. H. VAN ZWALUWENBURG and R. VIDAL (Porto Rico Sta. Circ. 16 (1918), pp. 12, figs. 5).—This circular, which is based largely on Bulletin 55 of the Bureau of Entomology of the U. S. Department of Agriculture (E. S. R., 17, p. 885), gives directions for the rearing of queen bees in Porto Rico. It is pointed out that degenerated stock is the principal cause of poor honey production in Porto Rico, and that this fault can be remedied only by the introduction of fresh stock to be used as a basis for improving the standard of the apiary by constant and intelligent selective queen breeding.

Bee disease control, E. G. CARR (N. J. Dept. Agr. Circ. 3 (1917), pp. 50, pls. 11).—A report upon the occurrence of and control work with bee diseases in New Jersey, accompanied by maps which show the results of bee inspection work for the years 1912 to 1916, inclusive.

On three new parasitic acari, S. HIBER (Ann. and Mag. Nat. Hist., 8. ser., 29 (1917), No. 120, pp. 431-434).—*Chirodiscoides caria* n. g. and n. sp. from the guinea pig, *Demodex muscardini* n. sp. from dormice (*Muscardinus avellanus*), and *D. erinacei* n. sp. from an English hedgehog are here described.

Scale feeding habits of a Porto Rican milliped, *Rhinoecricus arboreus*, R. T. CORRON (Jour. Dept. Agr. P. R., 1 (1917), No. 3, pp. 175, 176).—This millipede has been found to feed upon scale insects in Porto Rico, the purple scale being preferred.

FOODS—HUMAN NUTRITION.

Commercial stocks of miscellaneous animal food products in the United States on August 31, 1917 (U. S. Dept. Agr., Office Sec. Circ. 101 (1918), pp. 19, figs. 15).—"Commercial stocks of cured hams, bacon, and shoulders in the United States on August 31, 1917, the date of the preliminary War Emergency Food Survey, were approximately 488,000,000 lbs. Nearly 85 per cent of these stocks were held by the meat packers. . . .

"The reports giving data for both August 31, 1917, and August 31, 1916, indicated an increase of 0.8 per cent in the total holdings. This net increase was due almost entirely to an increase in the holdings of storage warehouses.

"The stocks of cured and salted pork amounted to 215,000,000 lbs., the meat packers holding nearly 75 per cent of the total. . . . The stocks reported for 1917 were 5.5 per cent larger than those reported for 1916.

"The stocks of salted and cured beef amounted to 57,000,000 lbs., of which nearly seven-tenths were held by the meat packers. . . . A 35 per cent increase in total stocks of the United States was indicated for the year ending August 31, 1917.

"The holdings of dry-salted and cured fish, and fish in brine, amounted to approximately 115,000,000 lbs. About 51 per cent of these stocks were held by fish packers and wholesale fish dealers, and 30 per cent by storage warehouses. . . . There was an increase of about 6 per cent over the holdings of the previous year.

"Stocks of condensed and evaporated milk totaled 390,000,000 lbs. Condenseries and wholesale dealers each held about 30 per cent of the total stocks. Retail dealers held about 13 per cent, while storage warehouses and exporters held 11 per cent and 9 per cent, respectively. . . . The 1917 stocks were 77.5 per cent larger than those of 1916."

The supply of lard in the United States.—Its extent and distribution on August 31, 1917 (*U. S. Dept. Agr., Office Sec. Circ. 97 (1918), pp. 32, figs. 12*).—"This circular presents the results of the War Emergency Food Survey of August 31, 1917, so far as they relate to pure lard, lard compounds, and lard substitutes other than purely vegetable substitutes. For convenience, the term 'lard' has been used to designate this entire group of food products.

"The survey indicates that the total stocks of lard in the possession of commercial concerns on August 31, 1917, were approximately 240,000,000 lbs. of the total reported supply the meat packers held slightly more than 50 per cent; the wholesalers held, roughly, 16 per cent; the retail dealers, 14 per cent; the storage-warehouses, 10 per cent; and the bakers and a group of miscellaneous dealers, 10 per cent.

"The survey further indicates that the total stocks on hand August 31, 1917, were 6.3 per cent larger than stocks held on the corresponding date of 1916."

The supply of canned salmon in the United States.—Its extent and distribution on August 31, 1917 (*U. S. Dept. Agr., Office Sec. Circ. 98 (1918), pp. 13, figs. 6*).—"Detailed information concerning the extent and the distribution of the supply of canned salmon on August 31, 1917, is presented.

The commercial stocks amounted to approximately 310,000,000 lbs., an increase of 18.2 per cent over the previous year. Four-fifths of the stocks were located in the State of Washington, and nearly three-fifths were held by canners of sea food.

Commercial stocks of miscellaneous cereal and vegetable foodstuffs in the United States on August 31, 1917 (*U. S. Dept. Agr., Office Sec. Circ. 99 (1918), pp. 28, figs. 24*).—"Commercial stocks of several foodstuffs on August 31, 1917, are listed in this contribution from the Bureau of Markets. The total holdings were, for corn, 13,664,582 bu.; corn food products, 200,806,674 lbs.; beans, 3,212,749 bu.; rolled oats, 76,976,273 lbs.; rice, 192,124,953 lbs.; sirup and molasses, 43,571,916 gal.; vegetable oils, 36,631,369 gal.; and solid vegetable cooking fats, 35,529,611 lbs. The 1917 stocks for corn were 43.8 per cent smaller than in 1916, stocks of beans practically equal, and stocks of other foodstuffs from 12.3 to 42 per cent larger in 1917.

Sugar supply of the United States.—Its extent and distribution on August 31, 1917 (*U. S. Dept. Agr., Office Sec. Circ. 96 (1918), pp. 55, figs. 19*).—"This circular presents the results of the War Emergency Food Survey. It "indicates the sources of the country's sugar supply, the estimated extent of sugar shortage on the date of the survey and the probable reasons therefor, and the distribution of the existing stocks as compared with that of a year ago." Detailed information is given in the circular regarding the distribution of the stocks of sugar not only among the several classes of concerns from which information was secured, but also among the several States and the different sections of the country.

- On the basis of the returns from the survey, it is estimated that the stocks of sugar in commercial channels on August 31, 1917, were about 1,500,000 lbs., as compared with 2,000,000 lbs., on August 31, 1916."

Commercial stocks of wheat and flour in the United States on August 31, 1917 (*U. S. Dept. Agr., Office Sec. Circ. 100 (1918), pp. 37, figs. 171*).—"Total commercial stocks of wheat in the United States on August 31, 1917, the date of the preliminary War Emergency Food Survey, were approximately 75,000,000 bu., representing less than a two-months' supply.

- Of the stocks reported, more than four-fifths was held by elevators, mills, and wholesale grain dealers. The West North Central division of States, reported about one-third of the stocks of the entire country, while the East North Central and the Pacific divisions each reported about one-fifth of the total.

"About five-sixths of the reports, based on quantity reported, gave data not only for August 31, 1917, but also for the corresponding date of 1916. From these two-year reports it appears that the stocks of August 31, 1917, were only 36.9 per cent of the stocks on hand August 31, 1916.

- Total commercial stocks of flour in the United States on August 31, 1917, based on estimates from the survey, were about 12,000,000 lbs. This represents approximately a six-weeks' supply.

"The largest stocks of flour were reported by the group of flour mills, elevators, and wholesale grain dealers, which held a total of 3,631,653 bbls. Retail dealers held 2,456,826 bbls., and bakers 1,990,583 bbls. Five States held one-third of the total stocks of flour. These in order of their holdings were: New York, Pennsylvania, Illinois, Nebraska, and California.

"The stocks reported for August 31, 1917, were 75.7 per cent of those for August 31, 1916. The decrease in holdings was general among all groups and classes of concerns."

Use of wheat-saving cereals, HELEN L. GREEN, ALICE E. SKINNER, and LENORE RICHARDS (*Kans. State Agr. Col. Circ. 9 (1918), pp. 121*). In this circular, issued by the Subcommittee on Food Production and Food Conservation of the Women's Committee, Kansas State Council of Defense, recipes for the use of wheat-saving cereals are given, most of which make use of corn meal or corn flour, the substitutes most available for the Kansas housewife.

Hints to housewives on how to buy; how to care for food; meats; drippings and butter substitutes; substitutes for meats; fish; vegetables; cereals; bread; how to use left-overs; how to make soap; fireless cooker; canning fruits and vegetables; how to preserve eggs (*New York, N. Y.: Mayor Mitchell's Food Supply Committee, 1917, pp. 111*).—A general discussion of foods with recipes.

Ninth biennial report of the Food and Drug Department (*Kentucky Sta. Food and Drugs Bienn. Rpt., 9 (1915-1917), pp. 10*).—This gives a report of the work under the Kentucky Food and Drugs Act and the Kentucky Food Sanitation Act from July 1, 1915, to June 30, 1917.

[**Food and drug inspection**], E. F. LADD and ALMA K. JOHNSON (*North Dakota Sta. Spec. Bul., 4 (1917), No. 18, pp. 437-538*).—The sanitary inspection score card used in 1917 for all food producing and handling establishments in the State of North Dakota is given, also the names of firms and their ratings.

Annual report of the dairy and food commissioner of Wisconsin (*Ann. Rpt. Dairy and Food Comr. Wis. [1915], pp. 98*).—The work of the commissioner during the year ended June 30, 1915, is reported.

Digestibility of some nut oils, A. D. HOLMES (*U. S. Dept. Agr. Bul. 630 (1918), pp. 19*).—In this, the fourth of the series of bulletins dealing with the

digestibility of fats and oils (E. S. R., 36, p. 860), data regarding the digestibility of almond, black-walnut, Brazil-nut, butternut, English-walnut, hickory-nut, and pecan oils are reported. As in the former experiments, normal young men served as subjects and the nut oils studied were incorporated in a basal ration. The results are summarized as follows:

An average of 70 gm. of almond, 56 gm. of black-walnut, 81 gm. of Brazil-nut, 43 gm. of butternut, 78 gm. of English-walnut, 95 gm. of hickory-nut, and 104 gm. of pecan oil was eaten per subject per day in the experiments, out of a total of 71 gm., 68 gm., 84 gm., 46 gm., 80 gm., 97 gm., and 107 gm. of fat supplied by the respective diets. The oils were found to be well digested, the coefficients of digestibility being 97.1 per cent for almond oil, 97.5 per cent for black-walnut oil, 96.3 per cent for Brazil-nut oil, 95.4 per cent for butternut oil, 97.6 per cent for English-walnut oil, 99.3 per cent for hickory-nut oil, and 96.8 per cent for pecan oil.

The nut oils, which are liquid at ordinary temperatures, thus have practically the same digestibility as the common vegetable oils (cottonseed, peanut, olive, sesame, and coconut oils), which are also liquid at ordinary temperatures.

While in these experiments as much as 81 gm. of almond oil, 64 gm. of black-walnut oil, 100 gm. of Brazil-nut oil, 49 gm. of butternut oil, 108 gm. of hickory-nut oil, and 130 gm. of pecan oil were eaten per day by one of the subjects for a 3-day test period, no laxative effect was noted; accordingly the limits of tolerance for these fats seems in excess of these amounts. In the experiments with English-walnut oil the three subjects ate 69.9 gm., 83.8 gm., and 81.6 gm. per day, and all reported a slight laxative effect.

The values obtained for the digestibility of the protein and carbohydrates in the simple mixed diet eaten in conjunction with the different nut oils were in agreement with those obtained in the earlier experiments of this series, indicating that the nut oils did not exert any unusual influence on the digestibility of the foods eaten with them.

"The results of this study of the digestibility of these nut oils indicate that they are very well assimilated by the human body, and that whenever available they could be used freely for food purposes."

Bacteria in ice cream.—II, B. W. HAMMER and E. F. GOSS (*Iowa Sta. Bul.* 174 (1917), pp. 21).—A continuation of the study of bacteria in ice cream (E. S. R., 28, p. 166) is reported. The following conclusions were reached by the authors:

"The freezer may be an important source of contamination where an effort is being made to produce ice cream with a low bacterial count, and accordingly considerable attention should be given its care. Water sherbets contain but few bacteria compared to the number ordinarily found in ice cream. The counts on 17 samples ranged from 6 to 7,800 per cc. Ice cream other than vanilla ordinarily contain large numbers of bacteria. The counts on 13 samples ranged from 130,000 to 40,850,000 per cc. There is no evidence that there is an increase in the numbers of contained organisms during the proper storage of ice cream while commonly there is a decrease. These results apply to the organisms developing on agar held at 37° C. for 48 hours.

"There is an apparent increase in the number of bacteria as determined by the plate method during the freezing of ice cream. This is apparently due to the breaking up of the clumps of organisms as a result of the agitation in the freezer. There is usually a decrease in the number of bacteria in ice cream during the hardening process, presumably as a consequence of the destructive action of the lowered temperatures.

"The softening and rehardening of ice cream may result in a significant increase or in a decrease in the number of bacteria contained. The effect is

probably dependent on the types of bacteria present and on the extent of the softening, a decrease being more likely to occur when the ice cream is softened at a higher temperature since, under these conditions, the rehardening has a more destructive action."

The dietary deficiency of cereal foods with reference to their content in "antineuritic vitamin," C. VOEGTLIN, G. C. LAKE, and C. N. MYERS (*Pub. Health Rpts. [U. S.], 53 (1918), No. 18, pp. 647-666, figs. 7*).—The report deals with the occurrence of the antineuritic vitamin (water-soluble B) in corn and wheat. Experiments were made on laboratory animals (chickens and pigeons) to determine whether bread made from "white" flour or highly-milled corn meal includes all the essential food elements contained in the intact grain. The following conclusions are reached:

"The results obtained in this investigation clearly show that for pigeons an exclusive diet of whole wheat or corn furnishes an adequate supply of antineuritic vitamin. The antineuritic vitamin seems to reside in the peripheral layers and the germ of these seeds, whereas the endosperm is relatively poor in this substance.

"If wheat and corn foods containing only a small percentage of the peripheral layers and germ of the seed are fed to pigeons and chickens exclusive of other food, polyneuritic symptoms appear on an average of three weeks after the beginning of the feeding period. The appearance of polyneuritis is preceded by a gradual loss in body weight. The birds can be relieved of their paralysis in a striking way by the oral or subcutaneous administration of a highly concentrated preparation of antineuritic vitamin derived from 'whole wheat' bread, yeast, ox liver, rice polishings, or beans.

"The addition of yeast (in amounts used by bakers) in the preparation of bread from highly-milled flour does not prevent the appearance of polyneuritis in birds fed on this food [exclusively], but prolongs slightly the period of incubation. The addition to 'highly-milled' flour, or bread made from 'highly-milled' flour, of a small amount of antineuritic vitamin preparation will correct this particular dietary deficiency, and will prevent the appearance of polyneuritis and the loss of body weight. The total phosphorus content of corn and wheat foods is a fairly satisfactory index of the amount of antineuritic vitamin contained in these foods. In a general way, it can be said that a high total phosphorus content is an indication that the particular corn or wheat product is relatively rich in antineuritic vitamin."

The origin of creatin.—II, L. BAUMANN and H. M. HINES (*Jour. Biol. Chem., 51 (1917), No. 3, pp. 549-559*).—Continuing previous work¹ this article reports experiments made to determine whether the animal organism possesses the power to convert glycocyamin into creatin.

The authors conclude that their experiments offer no "evidence for the methylation of glycocyamin by muscle or liver tissue in vitro. The injection of glycocyamin into rabbits and dogs may be followed by an increased excretion of creatin."

The effect of starvation on the catalase content of the tissues, W. E. BURGE and A. J. NEILL (*Amer. Jour. Physiol., 43 (1917), No. 1, pp. 58-61*).—Experiments made upon 12 laboratory animals (rabbits) led the authors to conclude that the "catalase content of the heart, which is not autolyzed during starvation, remains normally high while the catalase content of the fat and skeletal muscles, which are autolyzed during starvation, is greatly decreased. In view of the fact that the catalase content of a muscle is directly proportional to the amount of oxidation in the muscle, and that the autolyzing

¹ *Jour. Biol. Chem., 22 (1915), No. 1, pp. 49-53.*

enzymes are destroyed by oxidation, the further conclusion is drawn that the heart is not autolyzed during starvation, because oxidation in this organ remains normally intense, and thus provides for this oxidation of the autolyzing enzymes and the maintenance of the normal balance between oxidation and autolysis; on the other hand, the fat and skeletal muscles are autolyzed during starvation because of the decreased oxidation, which leaves the autolytic enzymes free to digest these tissues."

The effect of thyroid feeding on the catalase content of the tissues, W. E. BURGE, J. KENNEDY, and A. J. NEILL (*Amer. Jour. Physiol.*, 43 (1917), No. 3, pp. 433-437).—The object of this investigation was to determine whether thyroid feeding increases the catalase content of certain tissues, which would account for the increased oxidation of animals fed thyroid, while in other tissues, such as the muscles and fat, it causes a decrease in oxidation, which would account for the increased autolysis in these tissues. Experiments were made with cats. The following conclusions were reached:

"Thyroid feeding increases the catalase of the blood and decreases it in the heart and probably in the fat and skeletal muscles. The increased catalase of the blood may account for the increased oxidation in animals to which thyroid is fed, while the decreased catalase in the heart, skeletal muscles, and fat may account for the increased autolysis in these tissues, the idea being that when oxidation is decreased in these tissues a smaller amount of the autolyzing enzymes is oxidized and destroyed, resulting in an increase in the rate of autolysis."

The rôle of catalase in acidosis, W. E. BURGE (*Science*, n. ser., 47 (1918), No. 1214, pp. 347, 348).—From observations made upon the catalase content of the blood of animals under conditions of pancreatic diabetes, "surgical shock" anesthesia, and starvation, the conclusion is drawn that the defective oxidation in diabetes and the decreased oxidation in anesthesia, starvation, and "surgical shock," with resulting acidoses, is probably due to the decrease in catalase.

ANIMAL PRODUCTION.

Wintering and fattening beef cattle in North Carolina, W. F. WARD, R. S. CURTIS, and F. T. PENN (*U. S. Dept. Agr. Bul.* 628 (1918), pp. 53, figs. 8).—This work, done in cooperation with the North Carolina Experiment Station, covers the results of three years' experiments with beef cattle in the western part of the State. It is deemed applicable to similar conditions prevailing in the mountainous sections of the Virginias, Carolinas, Kentucky, Tennessee, and Georgia. The following studies are reported:

I. *Wintering steers preparatory to grazing on pasture*.—Cattle in the mountainous sections are usually carried through the winter on light maintenance rations and put on pasture the following summer for gains when feed is more abundant. The objects of this experiment were to determine the costs and methods of wintering stock cattle, the value of feeding for the maintenance of weights, and the effects of wintering on the gains on pasture during the following summer. The results cover three years with four lots, the first and second lots averaging 24 head, the third 33, and the fourth 19. Lot 1 was wintered on ear corn, corn stover, hay, and straw; lots 2 and 3 on corn silage, stover, hay, and straw; and lot 4 on winter pasture, being fed dry roughage and corn only when snow was on the ground.

For the three years the steers in lot 1 cost \$11.13 to winter, and lost an average of 32 lbs. per head each season, the increased cost per 100 lbs. in the spring being \$1.74. Lot 2 cost \$7.11 to winter, lost 51 lbs. each, and

had an added cost in the spring of \$1.40 per 100 lbs. Lot 3 cost \$6.76 to winter, lost 32 lbs. per head per season, and had an added cost of \$1.47 per 100 lbs. Lot 4 cost \$5.39, gained an average of 20 lbs. per season, and had an added cost in the spring of 68 cts. per 100 lbs. In these experiments the average requirements of pasture for the winter were 1.8 acres per head.

II. *Winter grazing of steers.*—In the second experiment the winter grazing of cattle was tried out on mountain cut-over lands too steep for general agriculture. The coves and flats were seeded to a mixture of 15 lbs. of orchard grass, 4 lbs. of blue grass, and 7 lbs. of timothy and clover per acre sown in corn at its last cultivation. This was allowed to grow during the following summer to make winter pasture. During the three years of the experiment the cattle were put on the pasture late in the fall and were without shelter during the entire winter. During stormy weather it was necessary to feed, this period averaging less than three weeks each season.

The first year 17 cattle on pasture cost \$4.66 per head to winter and weighed 17 lbs. heavier in the spring; the second winter 26 head averaged \$6.29 to winter and were 17 lbs. heavier; the third winter 16 head averaged \$5.23 to winter and weighed 26 lbs. more per head in the spring. The average cost per head for three years was \$5.39, approximately one-half of what it cost to dry-feed cattle in the barn, besides showing a gain in weight while the latter showed a loss. Winter grazing and the use of the silo promise greater gains in these rough mountain lands in wintering cattle than the old methods of using dry harvested roughage.

III. *Summer fattening of steers.*—This experiment, carried on for three years, was made with the steers wintered on dry roughage, on dry roughage and silage, and on winter grass. Most of the mountain cattle are finished on grass, but these were finished on grass alone and on grass with cottonseed cake. During the first two summers the feeding of cottonseed cake on grass was profitable, but in the third season it was not so, owing to its high price.

The results show that the cattle that had been wintered on pasture produced the best gains the following summer with an average of 350 lbs. per head at a cost of 3.1 cts. per pound. The next most economical results were made by the cattle wintered on silage, stover, and hay, followed by grass in summer. They made an average gain per head for the summer of 319 lbs. at a cost of 3.9 cts. per pound. The dry-fed wintered cattle on grass the following summer made an average gain of 344 lbs. per steer at a cost of 4.8 cts. per pound. The silage-wintered cattle on summer pasture and cottonseed cake made gains of 328 lbs. at a cost of 6.5 cts. per pound, compared with 3.8 cts. per pound without the cake. The cattle wintered on dry rations during the following summer on pasture made gains of 314 lbs. at a cost of 7.4 cts. per pound with cake, contrasted with gains at a cost of 4.8 cts. per pound without the cake.

IV. *Winter fattening of steers.*—It is the custom in the mountain districts to sell the steers in the fall as feeders. There are, however, oftentimes corn and roughages available for fattening such cattle. These experiments were carried out to test the profitableness of utilizing these home-grown feeds supplemented with cottonseed meal and hulls.

In the winter of 1913-14 one lot of 12 steers was fed cottonseed meal, cottonseed hulls, corn stover, and hay. A second lot of 12 was fed the same plus ear corn. During 113 days the steers in lot 1 averaged an increase daily of 1.36 lbs. per head at a cost of 13.32 cts. per pound, and lot 2, 1.42 lbs. at 13.52 cts. per pound.

In the winter of 1914-15 four lots of steers consisting of 10, 10, 21, and 26 head each were fed. All the animals received cottonseed meal. In addition

those in lot 1 were fed ear corn and cottonseed hulls, in lots 2 and 4 cottonseed hulls, and in lot 3 corn silage. The steers in lots 1, 2, and 3 were fed 96 days and those in lot 4, 111 days. Those in lot 1 made an average daily increase of 1.61 lbs. per head at a cost of 12.96 cts. per pound; lot 2, 1.42 lbs. at 11.21 cts.; lot 3, 2.07 lbs. at a cost of 7.6 cts.; and lot 4, 1.43 lbs. at a cost of 9.4 cts. per pound.

From the two years' work the following conclusions are drawn, applicable to local conditions: Good hay materially increases the cost of fattening and should be replaced by cheaper roughages where possible. Ear corn increases gains and improves the finish. The cost and availability of corn for fattening cattle should be carefully reckoned and compared with cottonseed meal when rationing. The gains with corn silage in the experiments are striking, and attention is called to the value of corn for ensiling and its utilization in this form in the region for cattle feeding. Cottonseed meal, even in moderate amounts, proved efficient, and it, as also cottonseed hulls, produced economical and satisfactory gains.

Owing to the long shipping distances the shrinkage of these cattle on shipment to market was large. It was fairly uniform on all lots.

Farmers with surplus feed, especially roughages, should feel safe in feeding steers in the winter when the prices of feeders and cottonseed meal are favorable and shipping points for fat cattle are not too far distant.

The utilization of dry farm crops in beef production, L. FOSTER and H. G. SMITH (*New Mexico Sta. Bul. 108 (1917), pp. 34, figs. 6*).—These experiments, carried out in cooperation with the Bureau of Plant Industry of the U. S. Department of Agriculture, covered three winter periods. They were made to determine if local crops grown under dry-farming conditions could be profitably employed in feeding range steers for beef. The feeds used were milo maize, Kafir corn, and other sorghums, and cowpea hay fed dry and ensiled. Cottonseed meal also used was the only feed brought in. The steers were range grown in the neighborhood of Tucumcari, N. Mex., those of the first experiment covering 3-year-olds, those of the second under 17 months old, and those of the third were "long yearlings." Tables are given showing the costs of the locally grown feeds.

In the first experiment two lots of three steers each were fed ground milo maize heads and Kafir corn silage. In addition lot 1 was fed cowpea hay and lot 2 cottonseed meal and shredded Kafir corn stover. The steers in lot 1 made an average daily gain per head for 76 days of 2.84 lbs. at a cost of feed per pound of gain of 4.19 cts. Those in lot 2 made a daily average gain of 2.39 lbs. at a cost per pound of 5.45 cts.

In the second experiment two lots of five steers each were fed the same rations as in the previous experiment. The steers in lot 1 made an average daily gain per head for 122 days of 2.14 lbs. at a cost of 4.78 cts. per pound of gain. Those in lot 2 made an average daily gain of 1.48 lbs. at a cost of 6.07 cts. per pound of gain. The average rate of gain in lot 2 was lowered by the results with one animal which was not a good feeder.

The third experiment was divided into two periods. The first test was made by 10 steers on 48 acres of pasture for 50 days, and being fed in addition 25 lbs. of cottonseed cake daily and as much Kafir corn silage as they would consume up to 200 lbs. They made an average daily gain per head of 1.71 lbs. at a cost per pound of 4.52 cts.

In the second period they were taken off pasture, divided into two lots of five each, and fed for 55 days. They were fed the same feeds as in the previous experiments except that shredded sorghum fodder was substituted for the

shredded Kafir corn stover in lot 2. The steers in lot 1 made an average daily gain per head of 2.07 lbs. at a cost per pound of 5.98 cts. Those in lot 2 made a corresponding gain of 1.51 lbs. at a cost per pound of 8.43 cts.

These experiments indicate that feeds necessary for fattening range cattle with a properly balanced ration can be grown under local dry-farming conditions. Very favorable results are shown with cowpea hay compared with cottonseed meal that must be purchased. It may also take the place of alfalfa, as silage. Immature Kafir corn gave satisfactory results. The reservation of native pasture for winter feeding is deemed advisable from the results in the last experiment.

Cattle feeding.—XIII, Winter steer feeding, 1916-17. J. H. SKINNER and F. G. KING (*Indiana Sta. Bul. 206 (1917), pp. 3-27; popular ed., pp. 81*).—This is a continuation of work previously reported (*E. S. R., 36, p. 5641*). The object of the experiments was to obtain further information on the comparative value of leguminous hay alone and combined with corn silage for fattening cattle; to test the comparative value of clover with alfalfa hay for cattle on fall feed; and to test the value of a full feed of corn in the ration with a limited feed of corn combined with corn silage.

In a ration of shelled corn, cottonseed meal, and clover hay, the addition of 288 lbs. of silage daily displaced 2.79 lbs. of the corn and 11.46 lbs. of the hay per steer, while the rate of gain was increased 0.19 lb. per head daily and the cost of gain decreased \$2.48 per 100 lbs. With the same ration, except that alfalfa hay was used instead of clover hay, 34.21 lbs. of silage daily displaced 3.06 lbs. of corn and 13 lbs. of hay, while the rate of gain per day was lowered 0.15 lb. daily and the cost of gain decreased 41 cts. per 100 lbs. The steers with corn silage in the ration sold for 25 cts. per 100 lbs. higher than those without. The profit per steer, not counting that made by the pigs following, was increased \$10.08 each when silage was added to the ration containing clover hay and \$6.10 when silage was added to the ration containing alfalfa hay.

Cattle receiving a full feed of shelled corn in addition to a ration of cottonseed meal, corn silage, and clover hay made a daily gain of 2.5 lbs. at a cost of 17.51 cts. per pound of gain. They were valued at \$12 per 100 lbs. and made a profit, including that of pigs following, of \$35.65 per head. The steers on the same ration but with the corn eliminated consumed 19.34 lbs. of silage and 0.87 lb. of hay more per day. They gained 1.63 lbs. daily at a cost per pound of 14.87 cts., and when fat were valued at \$10.75 per 100 lbs. and gave a profit, including pork, of \$21.21 per head.

With one-half the corn eliminated the average increased silage consumption was 8.77 lbs. and hay 0.7 lb. daily. The steers gained 1.62 lbs. daily at a cost of 20.97 cts. per pound of gain, were valued at \$10.85 per 100 lbs. when fat, and returned a profit, including pork, of \$14.95 per head.

In the ration where no corn was fed the first month but afterwards added in increasing amounts to the fifth month when it was 11 lbs. daily per head, the average increased consumption of roughage was 10.15 lbs. of corn silage and 1.97 lbs. of hay daily per head. The steers gained daily 1.91 lbs. at a cost of 18.12 cts. per pound of gain. They were valued at \$10.85 per 100 lbs. when fat and yielded a profit, including pork, of \$20.53 per head.

In a comparison of clover and alfalfa hays with and without silage, the basal ration was made up of shelled corn and cottonseed meal. With clover hay as the roughage the steers consumed slightly less corn and much less hay than with alfalfa as the roughage. With clover hay they made an average daily gain per head of 2.31 lbs. at a cost of 19.96 cts. per pound of gain, while

those on alfalfa hay gained 2.16 lbs. daily at a cost of 21.77 cts. per pound. The animals on clover were valued at \$11.75 per 100 lbs. and returned a profit, not including that of pigs following, of \$10.85 per head. Those on alfalfa were valued at the same price and returned a profit of \$7.74 per head.

With clover hay and silage in the ration the animals consumed slightly more grain and hay but less silage than with the ration of alfalfa hay and silage. With the clover-silage ration the steers gained an average of 2.5 lbs. daily per head at a cost of 17.51 cts. per pound, while those on alfalfa-silage gained 2.01 lbs. daily at a cost of 21.36 cts. per pound. Valuing the two lots at \$12 per 100 lbs. when finished, the clover-silage lot yielded a profit, not including that of pigs following, of \$20.93 per head compared with \$13.84 for the alfalfa-silage lot.

Digestion of starch by the young calf. R. H. SHAW, T. E. WOODWARD, and R. P. NORTON (*U. S. Dept. Agr., Jour. Agr. Research*, 12 (1918), No. 9, pp. 575-578, fig. 1).—This investigation was undertaken by the Dairy Division of this Department to ascertain how early in life the calf can utilize starch or starch-containing feeds.

Digestion experiments were conducted with two male calves. Beginning at 4 days of age each calf received 40 gm. of ordinary cornstarch per feeding, mixed with the milk, for a period of 3 days. Following this starch-feeding period the calves were fed whole milk solely for about 5 days, after which the starch was again fed for 3 days. The experiment continued until one calf was 39 days old and the other 31 days old.

From 4 to 7 days of age one of the calves digested 22.02 per cent and the other 20.3 per cent of the starch consumed. When calf 1 was 12 to 15 days old the percentage of starch digested had more than doubled, and when 3 weeks old it had nearly tripled, while at 4 weeks, in the case of calf 1, and 3 weeks, in calf 2, the percentage of starch digested was well over 90.

"While it is quite probable that a calf but a few hours old can not digest an appreciable amount of starch, it can readily be seen that the quantity of starch-splitting enzymes must increase very rapidly in the first few days of life, for the calves under experiment, when only 3 to 4 weeks old, were able to digest a ration nearly 10 per cent of the dry matter of which was starch. These results indicate that the milk ration of a calf but a few days old may be supplemented with a starchy food, and that the starchy material may be rapidly increased as the calf grows older."

The agricultural situation for 1918.—X, Wool.—War makes more sheep and wool necessary (*U. S. Dept. Agr., Off. Sec. Circ. 93* (1918), pp. 14).—This circular points out the effect of the war upon the requirements and supplies of wool, and gives reasons and plans for the immediate increase of sheep raising in the United States, especially on the ordinary farm. It is stated that before many decades have passed the United States should possess three or four times the present number of sheep, that a doubling of the present number within four years is possible, and that it would be of most valuable assistance to our war interests if such a result could be produced in a shorter time.

[Feeding experiments with pigs], G. S. TEMPLETON (*Alabama Col. Sta. Circ. 38* (1918), pp. 29, 30).—In a cooperative experiment in Bullock County 60 head of pigs were grazed on peanuts for eight weeks during the fall of 1917. Following the peanut-pasture period 45 head were divided into three lots of 15 each and fed the following rations for five weeks on dry lot: Lot 1, two weeks on corn and tankage and three weeks on corn and cottonseed meal (2:1) in self-feeders; lot 2, corn and velvet beans (4:1); and lot 3, corn and tankage in a self-feeder. The three lots were classified by the packing company to which they were sold as medium soft, indicating that the finishing period increased the

value of the pigs 1 ct. per pound over straight peanut-fed pigs. Lot 3 returned the greatest profit and lot 2 the least profit per head.

[Feeding pigs corn, velvet beans, and peanuts], G. S. TEMPLETON (*Alabama Col. Sta. Rpt. 1917*, pp. 23, 24).—In an experiment in feeding pigs on corn, velvet beans, and peanuts in various combinations, the velvet-bean meal produced a carcass as firm as that of the pigs fed on corn. In appearance the fat was slightly darker. The carcass of the pigs fed on peanut meal and corn (1:1) was somewhat softer than the corn-fed carcass, while that of those fed on peanuts and corn (1:1) was considerably softer.

The influence of the ration upon the intestinal flora of swine, L. D. BUSHMILL and J. J. FREY (*Kansas Sta. Tech. Bul. 3* (1917), pp. 3-54, figs. 3). The literature of the relation of bacteria to the development of higher animals, the harmful and beneficial influence of bacteria in the intestinal tract, and the effect of diet upon the intestinal flora is reviewed, and a bibliography of 78 titles is listed.

An investigation was made of the effect of different diets upon the intestinal flora of pigs as shown by the Gram method of staining, and the influence of these diets upon the number and types of bacteria in the feces. A special study was made of the effect of such diets upon the *Bacillus coli* group in the intestinal contents and feces of the pigs. The six pigs used in the studies were given the experimental diet for 200 days from the time of weaning. Four of the pigs were fed corn meal alone, and the other two corn meal plus the albumin from 12 lbs. of milk to each pound of corn meal. Three of the corn-fed pigs gained in weight from an average of 30.6 lbs. each at the beginning of the test to 79 lbs. at the end of the 200 days, while the two corn-and-protein-fed pigs gained from an average of 29.8 to 268 lbs. The fourth pig of the corn-fed group was kept on the corn-meal diet for about 18 months. This pig made only slight gains for 13 months, but during the next 5 months gained about 140 lbs., due mostly to the laying on of fat.

The Gram method was found to be an index to the influence of diet upon intestinal flora only within limits. Observations made upon samples taken from the stomach and at about each 6-ft. level of the intestines to the rectum of two slaughtered pigs showed that the Gram-positive types were more prevalent at lower levels in the corn-and-protein than in the corn-alone pig. *B.-coli*-like organisms were isolated from the stomach and at each level below to the rectum in the corn-alone pig, while in the corn-and-protein pig organisms of this type were not found in the stomach or for about 18 ft. below in the small intestine. All the data obtained indicate that about 10 per cent more organisms are present in the feces of corn-and-protein pigs than in the feces of corn-alone pigs. There were, however, great individual and daily variations. In reference to the types present, there were great individual variations in the mixed intestinal flora, but it was noted that pigs on a corn diet generally show a slightly more simplified flora than pigs fed on a more complex diet.

"There is a tendency for a diet of corn alone to throw the varieties of the colon bacilli into the *B. communis* variety rather than into the *B. communior* variety. This is not due entirely to the physical condition of the feces, as the poverty of *B. communior* was as marked in the contents of the intestine as in the feces. Small variations in diet affect the intestinal flora, but very little as compared to highly carbonaceous or nitrogenous diet. A study of the fermenting capacity of the colon bacilli will not explain the difference in metabolism in pigs on a strict corn diet and one of corn plus milk albumin. It is not possible to attribute the stunting effect of a strictly corn diet to marked variation in the bacterial flora of the alimentary canal as determined by the present technique."

Winter cycle of egg production in the Rhode Island Red breed of the domestic fowl, H. D. GOODALE (*U. S. Dept. Agr., Jour. Agr. Research*, 11 (1918), No. 9, pp. 547-574).—At the Massachusetts Experiment Station the daily egg records of three flocks of Rhode Island Red pullets, hatched, respectively, in 1913, 1915, and 1916, were biometrically analyzed and compared with monthly egg records of White Wyandottes and Barred Plymouth Rocks reported by Gowell from the Maine Experiment Station (*E. S. R.*, 15, p. 394).

The winter cycle was found to be much more characteristic in the Maine Station flocks than in the Massachusetts Station flock. In the case of the Rhode Island Reds the winter cycle could be determined in only a portion of the flock. As to the evidence of a winter cycle in the individual, it is concluded that (1) the rate of production as shown by the monthly egg records is not a satisfactory index of a winter cycle in the individual Rhode Island Red pullet. (2) The best criterion of the existence of a winter cycle in the individual is the existence of a pause in production in one or more of the winter months, followed by a period of continuous egg production, and usually exceeding 10 days in length. (3) In some instances a pause of 10 days or less occurring in February or March, and following a period of several weeks of continuous egg production, may delimit the winter cycle. In cases where winter pauses could be determined with some accuracy, practically no correlation was found between the number of eggs laid before the pause and the length of the pause.

Evidence is presented which indicates that the winter cycle of egg production may be inherited in some definite but undetermined manner.

Successful incubation practices in New Jersey, embryo mortality, R. R. HANNAS (*New Jersey Stat. Hints to Poultrymen*, 6 (1918), No. 5, pp. 4).—Among points considered are the location of the machine, the holding of the eggs at a low temperature with moist air in the room, and daily turning, and the operation of the incubator at the proper temperature, with care in turning, cooling, and sanitation.

In a trial in holding eggs with 900 eggs in three lots those kept at 45 to 50° gave 57 per cent hatch; those at 60 to 65°, 51.3 per cent hatch; and those at 75 to 80°, 33.7 per cent hatch.

Cooling seems to make no difference in the percentage in the hatch, but there is possibly a heavier chick produced where it is practiced. From a trial with 1,500 eggs in three lots extreme cooling gave 66.7 per cent hatch, medium cooling 68.8 per cent, and no cooling 65.5 per cent. Those receiving extreme cooling hatched a day late, with medium cooling on time, and with no cooling a day ahead of time. The chicks averaged in weight 1.35, 1.32, and 1.27 oz. for the respective lots.

DAIRY FARMING—DAIRYING.

Feeding for milk production, J. M. SCOTT (*Florida Sta. Bul.* 143 (1918), pp. 79-88, fig. 1).—Part of the experiments here reported, comparing sorghum silage with Japanese cane silage and with sweet potato silage for dairy cows, has already been noted (*E. S. R.*, 37, p. 683).

In an experiment with three lots of three cows each, covering three 20-day periods, the rations consisted of 9 lbs. of wheat bran and 12 lbs. of silage, and in addition 3 lbs. of cottonseed meal for lot 1, 4 lbs. of peanut meal for lot 2, and 6 lbs. of velvet bean meal for lot 3, these concentrates being changed so that each lot of cows received a different concentrate during each 20-day period. The cows varied but little in live weight during the test. On velvet bean meal the cows produced 2,818.4 lbs. of milk, on peanut meal 2,755.3 lbs., and on

cottonseed meal 2,601.8 lbs. of milk. With peanut meal at \$40, velvet bean meal at \$32, and cottonseed meal at \$50 a ton, milk was produced at 16, 10.5, and 16.6 cts. per gallon, respectively, when these concentrates were fed.

Corn silage and sweet potato silage were fed by the reversal system to two lots of seven cows each during four 16-day periods. In addition, the cows were fed a ration of 2.5 lbs. of cottonseed meal and 7.5 lbs. of wheat bran. Little variation occurred in the weight of the cows during the test. On corn silage the cows gave 7,888.3 lbs. of milk at a cost of 11.8 cts. per gallon, while on sweet potato silage they gave 7,598.4 lbs. of milk, at a cost of 14.2 cts. per gallon. In this test corn silage was valued at \$4 and sweet potato silage at \$13.33 per ton.

Dairying in Florida. J. M. SCOTT (*Florida Sta. Bul. 142 (1918), pp. 59-76, fig. 6*).—The author discusses the need for increased dairy production in Florida, especially on the average farm; the factors affecting cost of milk production; the improvement of dairy herds by selection, the use of good sires, and the raising of heifers from the best-producing cows; the effects of feeding stuffs on the color, odor, and composition of milk; qualifications of a good dairyman; and cow-testing associations.

The station herd is cited as an example of what may be accomplished in improving dairy herds by selection and by the use of good sires. Ten years ago the average annual milk production per cow of the 12 cows in this herd was 2,600 lbs. During the past year the average of the 20 cows in this herd was 4,440 lbs. The average total feed and labor cost of producing milk in the station herd during the past year was 19 cts. a gallon.

A study of share-rented dairy farms in Green County, Wis., and Kane County, Ill. E. A. BOEKER (*U. S. Dept. Agr. Bul. 603 (1918), pp. 14, fig. 1*).—The material for this study was obtained from 84 farm-management survey records made in Green County, Wis., in cooperation with the Wisconsin Experiment Station, and from 59 records made in Kane County, Ill., all for the crop year 1915, together with data from 147 survey records taken in the Illinois region by the Illinois Station in 1912.

With regard to rental terms, the landlord in the Illinois group generally owned the cows and paid all the farm road tax, while in the Wisconsin group he owned but half the cows and paid only part of the road tax. In the Wisconsin group 76 per cent of the leases ran for one year, none being for more than three years. In the Illinois group 63 per cent of the leases were for one year, none being for more than five years.

The average farm in the Wisconsin group had 140 acres tillable and 84 acres in pasture and supported 25 cows. The Illinois farms averaged 130 acres tillable and 58 acres in pasture and supported an average of 43 cows. The Wisconsin cows produced an average of \$70 worth of dairy products, and the Illinois cows \$94 worth per head annually. In the Wisconsin group both landlord and tenant made least on farms selling milk fat, more on farms marketing milk through the cheese factory, and most on farms selling milk to condenseries. In the Illinois group none of the milk was made into cheese, and the profits were about the same, both to landlord and tenant, whether the milk was sold to the condenser or for market. The introduction of purebred cows into the dairy herd in the Wisconsin group has been very profitable both to landlord and tenant, but apparently only to the tenant in the Illinois group.

In both the Wisconsin and Illinois groups the tenant remained on the farm longer under the yearly lease than he did where the lease was for a longer period.

Milk goats, E. L. SHAW (*U. S. Dept. Agr., Farmers' Bul. 920 (1918), pp. 26 figs. 18*).—A general treatise on the status of the industry in the United States, the character of goat's milk, and the breeds, breeding, care and management, and diseases of goats.

It has been found that goat's milk can be thoroughly separated in a separator. When goat's milk testing 4.4 per cent fat was run through the separator the skim milk tested only 0.03 per cent fat. The composition of the milk in the Bureau of Animal Industry's herd of common American goats averaged the following percentages: Specific gravity, 1.0338; fat, 5.99; solids-not-fat, 10.97; sugar, 4.93; protein, 4.63; and water, 83.04. Tests indicate that when goat's milk and cream are properly handled butter of a good quality and free from objectionable features may be secured. Directions are given for the manufacture of cheese from goat's milk. Results secured in a cooperative experiment by the Sea View Hospital, New York, and the Bureau of Animal Industry upon the value of goat's milk for tuberculous patients were entirely negative.

The essentials of a goat dairy are noted, and the floor plans and details are given of the goat dairy at the department experiment farm at Beltsville, Md. Breeding experiments at this farm have involved the crossing of pure-bred Saanen and Toggenburg bucks on common American does. The crossbred goats from each of these breeds have shown great improvement over the common goat. The grade Saanen does have had a lactation period of from 7 to 10 months and have given an average of 3.1 lbs. of milk per day, ranging in fat content from 4 to 6 per cent. The grade Toggenburg does have milked from 6 to 10 months and produced an average of 3.2 lbs. of milk per day, the fat content of which ranged from 4 to 6 per cent. The average weight of the mature half-Saanen does in 1917 was 129 lbs., and of the half-Toggenburg does 108 lbs. In 1915 the average daily milk yield per head of 10 selected common does was 1.5 lbs. for periods of from 7 to 10 months. This milk ranged in fat content from 6.5 to 9.4 per cent.

The Bureau herd of does in milk are fed in winter a ration of 2 lbs. of alfalfa or clover hay, 1.5 lbs. of silage or turnips, and from 1 to 2 lbs. of a grain mixture of corn, oats, bran, and linseed meal (10:10:5:1). On pasture the does are fed from 1 to 1.5 lbs. of a grain mixture of corn, oats, and bran (2:2:1). In 1916 the herd of 10 grade Toggenburg and Saanen does during their lactation period required 1.21 lbs. of grain to produce a quart of milk.

The milch goat, A. C. McCANDLISH and L. S. GILLETTE (*Idaho Sta. Circ. 2 (1918), pp. 4*).—Brief notes are given on the adaptations, breeds, feeding, management, and product of milch goats.

Germ content of milk.—II, As influenced by the utensils, M. J. PATTON, H. M. WEETER, and W. H. CHAMBERS (*Illinois Sta. Bul. 204 (1918), pp. 257-257, fig. 1*).—In continuation of the study of the relative importance of the various channels through which bacteria enter milk (*E. S. R.*, 37, p. 644), results are here given of investigations begun in 1913 upon the influence that the various utensils in which milk is normally handled exert upon the germ content of the milk. In part 1 of the bulletin are reported the results of experiments in which the influence was studied by direct examination of the cans and bottles. The aim of these tests was to determine the number of bacteria in freshly washed unsteamed cans and bottles, whether bacteria increased in washed utensils before being filled, and the source of these bacteria.

The study of bacteria in freshly washed cans was made with 170 cans that had been used in shipping sweet milk from 37 farms to two dairies. In dairy A the milk handled in the cans had a low germ content. The number of cans washed in the same lot of wash water was from 20 to 30, and the amount of

wash water used was 60 gal., the cans being rinsed after washing. In dairy B the milk had a high germ content. From 60 to 80 cans were washed in the same lot of wash water, the amount of water being about 25 gal., and the cans were not rinsed after they were washed. The cans were washed immediately after the milk was poured from them, and the plating of the rinse water was made in from one-half to four hours.

More than 1,000,000,000 bacteria were removed from each of 39 of the cans washed in dairy A, and from each of 38 others the number was more than 100,000,000. Even larger numbers were removed from the 56 cans washed in dairy B. In only 4 of the cans in this dairy was the number smaller than 100,000,000. Had these 170 freshly washed cans been filled with sterile milk the resulting germ content would have varied from 197 to 2,557,000 per cubic centimeter. The results of successive rinsings with sterile water indicate that, while a considerable fraction of the germ life in the cans was removed by the first rinsing, it is by no means the entire germ life present.

Fifty cans washed, steamed, and left 30 hours uncovered and inverted on a rack, if filled with milk would have added to the milk an average of 8 bacteria per cubic centimeter. Fifty cans similarly cleansed but left 30 hours with the lids on, if filled with milk would have added to the milk an average of 1,816 bacteria per cubic centimeter. Fifty cans washed but not steamed and held 30 hours uncovered and inverted on a rack, if filled with milk would have added to the milk an average of 27,164 bacteria per cubic centimeter. Ten cans similarly cleansed, but held 30 hours with the lids on, if filled with milk would have added to the milk an average of 128,730 bacteria per cubic centimeter. Ninety-one milk cans that had been washed, rinsed, and steamed at two dairies and covered with their lids, examined as they were about to be used on several dairy farms showed that had they been filled with milk they would have added to the milk an average of 23,523 bacteria per cubic centimeter. The treatment of these cans at the farms was not uniform, either as to their being kept covered or as to the length of time elapsing before their use.

A comparison of the germ content of each of 153 milk cans after the cans had been emptied and washed, but not rinsed or steamed, and the germ content of the milk previously held by the cans, in most cases revealed no direct relationship. However, taken as a whole, the dairy which received the milk with the higher germ content also had the cans with the higher germ content.

An examination of 134 freshly washed cans and of the water in which they were washed showed that the wash water became heavily seeded with bacteria during the washing process. However, the extremely large numbers of bacteria found in some of the washed cans could not be accounted for by contamination from the wash water.

Bacterial counts were made of a number of washed but unsteamed milk bottles. The results show that if these bottles had been filled with milk the germ content of the milk would have been increased by an average of 1,339 bacteria per cubic centimeter by the freshly washed bottles and 12,930 bacteria per cubic centimeter by the bottles held 24 hours after washing.

The experiments reported in part 2 were designed to test the influence of the various unsteamed utensils upon the germ content in actual dairy operations, as shown by the difference in the germ content of the milk handled in steamed and in unsteamed utensils. The steaming consisted in holding the utensils in a chamber filled with flowing steam for about an hour, except that some of the pails and cans were held over a steam jet for two to three minutes. Bacterial examination of the utensils showed that this steaming was satisfactory.

An examination of 81 cans of milk at the farm ready for transportation to the dairy, when all utensils had been carefully steamed, showed an average germ content of 6,807 bacteria per cubic centimeter. A similar examination of the milk in 117 cans from the same farms, when all utensils were similarly treated, except that the steaming was omitted, showed an average germ content of 285,000 bacteria per cubic centimeter.

When the bottle filler was carefully washed and steamed it exerted no appreciable effect upon the germ content of the milk passing through it. When it was similarly washed, but not steamed, the germ content of the milk of the first bottle was increased on the average by 96,900 bacteria per cubic centimeter. The continued use of the bottle filler gradually washed the larger part of the germ life from the machine.

A study of the collective influence of all the utensils that normally come into contact with the milk, both at the barn and at the dairy, showed that when all the utensils were carefully steamed the germ content of the milk in the bottles was about 4,566 bacteria per cubic centimeter. When similar conditions obtained, except that the steaming of the utensils was omitted, the germ content of the milk approximated 257,240 bacteria per cubic centimeter.

Of all the various utensils coming into contact with the milk at the barn and at the dairy, the clarifier and the bottle filler when unsteamed proved to be the most prolific sources of contamination. The clarifier added an average of 141,340 bacteria per cubic centimeter to the milk passed through it, while the bottle-filler tank and the four valves of the filler added approximately 436,000 bacteria per cubic centimeter to the same milk.

Factors of importance in producing milk of low bacterial count, C. L. ROADHOUSE (*California Sta. Circ. 179 (1917), pp. 11, figs. 6*).—This circular points out briefly the principal sources of microorganisms in milk, and explains how the care of milk leads to a lower bacterial content. Specifications are given for the construction of an inexpensive combination hot-water heater and steam sterilizer for dairy utensils.

The pasteurization of sour, farm-skimmed cream for butter making, O. F. HUNZIKER, G. SPITZER, H. C. MILLS, H. B. SWITZER, ET AL. (*Indiana Sta. Bul. 208 (1917), pp. 3-76*).—The experiments here reported were undertaken to determine (1) the effect of pasteurization of sour, farm-separator cream on the flavor, keeping quality, and market value of butter; (2) the effect of different processes of pasteurization on the bacterial count of cream and butter and on the flavor and keeping quality of butter; (3) the effect of pasteurization on the chemical properties of fresh and stored butter; (4) the causes underlying the changes in the flavor of raw and pasteurized cream butter in storage.

In each set of experiments about 1,600 lbs. of 30 to 40 per cent cream of 0.3 to 0.7 per cent acidity was used. This cream was divided into four churnings, as follows: (1) Churned raw; (2) pasteurized at 145° F., holding for 20 minutes; (3) pasteurized at 165° flash process; (4) pasteurized at 185° flash process. Five-lb. cartons of the butter were held in cold storage at from 0 to 20°, and were scored when fresh and when 30, 60, and 90 days old. The average scores of 204 churnings indicate that the butter from the raw cream possessed the poorest keeping quality, scoring 3.03 points lower when fresh and 4.51 points lower when 90 days old than the butter from cream pasteurized at 145° holding process, which scored highest when fresh and after storage. Butter from cream pasteurized at 165 and 185° flash process had a pronounced oily flavor. The flavor largely disappeared in storage, but flavors characteristic of storage butter developed.

On the basis of market conditions at the time of this study, the butter from the pasteurized cream, averaged, after 30 days' storage, from 0.8 to 0.9 ct. in

the case of the flash process, to 1.7 cts., in the case of the holding process, higher in price than the butter made from raw cream.

The holding process of pasteurization at 145° was most efficient, averaging over 99.9 per cent in its germ-killing effect on all types of microorganisms. The flash process at 185° lacked uniformity, and at 165° was deficient in germ-killing efficiency. The germ-killing efficiency of pasteurization in summer was greater and the keeping quality of such butter was better than that of winter cream and butter. However, pasteurization at 145° holding process destroyed over 99 per cent of the germ content of cream, regardless of the season of the year and variations in the resistance of different types of germs.

In order to test the effect of time of holding cream at 145° on the germ-killing efficiency and on the keeping quality of butter, cream was held at this temperature for 10, 15, 20, 30, and 40 minutes. From the standpoint of the keeping quality of the butter 20 minutes' holding proved best. The greatest reduction of microorganisms occurred when the cream was held at 145° for 40 minutes, and the germ-killing efficiency was greatly diminished when the time of exposure was shortened to 15 or 10 minutes. Butter from cream held at 145° for more than 20 minutes, however, contained as large numbers of liquefiers, yeasts, and molds as when held for 20 minutes only, and exposure at 145° for longer than 20 minutes was found to produce a mealy body in the butter under certain conditions.

Another experiment demonstrated the necessity of guarding against recontamination after pasteurization. It has been found that an unclean vat may reduce the efficiency of pasteurization 50 per cent. It was also shown that the better the flavor and the lower the acidity of the cream at the time of pasteurization, the better will be the flavor of the butter when fresh and when it comes out of storage.

In 104 churnings the average percentages of fat in the buttermilk were as follows: From raw cream 0.101, and from pasteurized cream at 145° held 20 minutes 0.137, at 165° flash 0.12, and at 185° flash 0.12. In these churnings there was a somewhat larger loss of fat from the high-acid cream than from the low-acid cream.

Pasteurization of cream had very little effect on the chemical composition of the butter. The moisture, curd, and acid were somewhat lower in the pasteurized cream butter than in the raw cream butter, and the highest temperature used for pasteurizing showed the greatest difference. There was a gradual decrease in lactose and increase in acidity of the raw and pasteurized cream butter after three months' storage; however, the raw cream butter increased far more rapidly in acidity than the pasteurized cream butter. There was also a decrease in the acidity of the fresh butter, due to pasteurization. The fat constants in butter in storage were found to undergo but very slight changes, and these changes averaged somewhat greater in raw cream butter than in pasteurized cream butter. Results of monthly analyses of milk fat held for one year at ordinary room temperature show that the fat constants in the stored fat underwent very slight changes, not at all commensurate with the degree of rancidity and tallowiness developed in the fat.

The hydrolyzed or cleavage products of the proteins in butter were determined in 64 separate churnings of the butter from raw and pasteurized cream, when the butter was fresh, and after storage at -6° for one, three, and five months, respectively. The results indicate that some protein decomposition takes place in all butter during storage even at a temperature below 0°, and it is suggested that this protein hydrolysis may, in a large measure, be responsible for off flavors in storage butter. Butter that is intended for prolonged storage should, therefore, be as free as possible from curd. It is also

noted that the protein hydrolysis was greatest in the raw cream butter and least in butter made from cream pasteurized at 185° flash process. The protein cleavage was greatly increased after butter had been transferred from cold storage to room temperature.

The causes of protein hydrolysis are discussed, and the methods used in these experimental analyses of the cream and butter are outlined. Detailed tabular data brought out in the study are appended.

Errors in the weight of print butter: Their causes and prevention. H. RUNKEL and H. M. ROESER (*U. S. Dept. Agr., Office Sec. Circ. 95 (1918), pp. 14 figs. 7*).—This circular, which is based upon studies by the Bureau of Chemistry in cooperation with the Division of Weights and Measures of the Bureau of Standards, is issued to show the responsibility of butter makers in complying with the requirements of the Federal net weight law and to suggest a procedure to reduce the inaccuracy and lack of uniformity in present methods of printing butter.

The average difference between the heaviest and lightest of 50 1-lb. prints selected at random in about 250 plants was 0.56 oz. The types of errors made by manufacturers may be due to (1) the difference of single prints from 16 oz. and (2) the difference of the average weight from 16 oz. Errors on single prints when the average is correct, are due principally to the physical condition of the butter, the inaccuracy of the printing machine, and the carelessness of the operator. These errors may be largely eliminated by attention to such details as uniformity of mixing, control of the temperature at which printed, securing a uniform solidity of the print, cutting all prints squarely, filling out the corners, preventing air holes in the middle of the print, elimination of worn utensils, and keeping cutting wires tight and the proper distance apart.

Errors on the average weight are due largely to inaccurate scales and incorrect methods of adjusting the machine. They may be largely eliminated by first securing an accurate scale and then looking carefully to its preservation; also by weighing at least 5 per cent of all prints in groups of five or ten at frequent intervals during each churning in order to check up the printing machine.

Actual conditions as they were found in the field are discussed and the relation of the different sources of error to one another is pointed out.

VETERINARY MEDICINE.

Preventive medicine and hygiene. M. J. ROSENAU (*New York and London: D. Appleton & Co., 1917, 3. ed., enl., pp. XXXVI+1374, pl. 1, figs. 206*).—This new edition is called by the author a "special" or "military" edition, inasmuch as it contains a discussion of the "duties and organization of the Sanitary Corps, the examination of recruits, diseases of the soldier, sanitation of troops in camp and on the march, sanitation of barracks and trenches, physical training, personal hygiene and equipment of the soldier, Red Cross, rations, etc., . . . and the 'new' diseases and new medical conditions which have arisen in the present world war, such as trench fever, trench foot, war nephritis, shell shock, gas poisoning, tuberculosis, venereal diseases, etc." The book contains chapters on Sewage and Garbage, by G. C. Whipple; Vital Statistics, by J. W. Trask; and Mental Hygiene, by T. W. Salmon.

Report of veterinarian. C. A. CARY (*Alabama Col. Sta. Rpt. 1917, pp. 25-27*).—Work with the kidney worm (*Stephanurus dentatus*) has shown that its eggs pass out from the body of its host in the urine and hatch at ordinary temperatures in about 17 days in urine, water, and moist soil. Its eggs were found in the urine in the bladder of a number of pigs,

Tests made of the action of "bitterweed" (*Helentium tenuifolium*) indicate that it is toxic for horses, mules, and dogs, but not so for cattle. A collection of 150 tabanids was made during the fall.

A series of tests made to determine the toxic action of *Eupatorium ageratoides* indicate that it produces progressive degenerative change in the red blood cells, polymorphonuclear cells, and eosinophils. In the cat, dog, and goat it failed to produce any symptoms resembling "trembles."

White snakeroot or richweed (*Eupatorium urticæfolium*) as a stock-poisoning plant, C. D. MARSH and A. B. CLAWSON (*U. S. Dept. Agr., Bur. Insm. Indus.*, 1918, pp. 7, fig. 1).—This is a popular summary of information, based upon the investigations previously noted (*E. S. R.*, 38, p. 685), in which it is pointed out that the losses of live stock from poisoning by this plant should be avoided by prevention rather than by reliance upon remedies. Since it takes a fairly large quantity to poison an animal, little harm will result from eating the plant for a short time unless the animal is unusually hungry.

Efficacy of some anthelmintics, M. C. HALL and W. D. FOSTER (*U. S. Dept. Agr., Jour. Agr. Research*, 12 (1918), No. 7, pp. 397-447, fig. 1).—In carrying out the series of experiments here reported the plan of the authors was to test as many drugs as possible having a known or alleged anthelmintic value, making further experiments with the more promising. The animals were given an appropriate dose of the anthelmintic to be tested. The treatment was usually administered in the morning and all feces were collected and examined every morning thereafter until the animal was killed, which was usually the morning of the fourth day after the administration of the last dose of the anthelmintic, and all parasites remaining were collected and counted.

The experimental data presented are arranged in three groups, (1) simple purgatives, (2) a group including anthelmintics having a mineral base and similar products, and (3) a group covering the vegetable anthelmintics. The conclusions drawn by the authors from the results of the investigations reported are as follows:

"Simple purgatives, calomel and castor oil, may have some slight value as anthelmintics, but it is hardly sufficient to justify their use for this purpose. Ascarids in dogs are sometimes removed by castor oil given as a preliminary purge, and this fact may prove of benefit in veterinary practice as a diagnostic measure when the more accurate method of microscope fecal examination can not be carried out. However, castor oil failed to remove ascarids more frequently than it succeeded, and in no case were all the ascarids removed from any one animal. As many of the experiments on dogs were preceded by a dose of castor oil, the writers have fairly extensive data on this subject.

"The most reliable vermifuge for ascarids, whether in dogs or swine, is oil of chenopodium. This drug, which was tested out on 34 dogs in six experiments, showed an efficacy for the entire series of 97 per cent. It rarely fails to remove all the ascarids present in a dog if given at the rate of 0.2 mil per kilogram, preceded by a dose of castor oil and the animal starved for 24 hours before treatment. The chenopodium treatment is also very efficacious for ascarids in swine and when properly administered may be expected to remove most, if not all, of the worms present. It would seem, however, that neither chenopodium nor any other drug tested will give satisfactory results if mixed with the daily ration and the animals allowed to dose themselves; it is best given to each pig individually in suitable dosage, preceded by a fast. While this method necessarily involves considerable labor when treating animals as unruly as swine, the labor can be reduced by sorting the hogs roughly into classes according to size and confining them in inclosures which will permit them to be caught with

a minimum amount of struggling. The treatment has proved practical on a large scale and the results, as far as they could be determined, were entirely satisfactory. Oil of chenopodium appeared to be effective for stomach worms in sheep, although the data on this subject are not sufficient to warrant its recommendation. It is also of some efficacy for hookworms in sheep and in dogs though in the latter case chloroform was found more reliable.

"Other remedies which seem to have more or less merit as anthelmintics against ascarids are the latex of *Ficus laurifolia*, santonin in repeated doses and thymol. Although thymol in repeated doses is fairly efficacious against hookworms, it was inferior to chloroform for this purpose, causing more distress. An excellent preparation for mixed infestation in dogs consists of equal parts of oil of chenopodium and chloroform, given at the rate of 0.2 mil per kilogram, combined with 30 mils of castor oil. This preparation may be expected to remove all the ascarids present, a large proportion of hookworms, and possibly a certain percentage of whipworms. This latter parasite seems to be very difficult to eliminate, and nothing tried by the writers proved very efficacious, almost any anthelmintic occasionally proving successful. This experience may perhaps be explained by an intermittent peristalsis of the cecum, which occasionally allows the anthelmintic to enter, but which usually excludes it. Although chloroform was fairly successful in removing stomach worms from sheep, both animals upon which it was tried subsequently died from its effects, and it would seem to be too dangerous for use on sheep.

"In the case of stomach worms in sheep, copper sulphate was found to be the most satisfactory remedy, the experiments confirming the findings of Hutcheon. A simple apparatus devised by the senior writer reduces the labor involved in drenching a flock of sheep and insures accurate dosage. Petroleum benzin also proved satisfactory and was more efficacious for hookworms than copper sulphate. However, it is much more expensive than copper-sulphate solution, must be given three times and in a vehicle like milk, which adds greatly to the expense. The fact that petroleum benzin (refined gasoline) proved efficacious, while commercial gasoline was considerably less so, is perhaps related to the differences in specific gravity and consequent volatility of the refined product compared with the commercial product.

"Among anthelmintics intended for use against tapeworms, male-fern proved efficacious when tested on dogs. In the case of cats it removed all tapeworms from 75 per cent of the animals tested, though it proved fatal to two out of six animals which were somewhat enfeebled from disease. Apparently it is more toxic to cats than dogs and should be prescribed with caution and only given to healthy subjects. So far as can be judged from a single experiment with dogs, there seems to be no danger in combining male-fern with castor oil, as is done in the so-called Hermann's mixture. In fact, the writers are inclined to agree with Selfert (1908) that the administration of castor oil after male-fern will avoid the toxic effects of the latter by causing its rapid and thorough elimination, and that for this purpose no other purgative is quite so effective. This subject, however, should receive more study before conclusions are drawn.

"Pelletierine tannate was a failure in the one experiment in which it was tested on cats but was efficacious on dogs. No remedy was efficacious against tapeworms in poultry. Of the four drugs tested, chenopodium gave the best results for this purpose, but its efficacy for tapeworms is very slight.

"Turpentine proved the most efficacious of the remedies tested on poultry for the removal of *Ascaridia perspicillum*, while chenopodium was nearly as good. When tested on dogs and pigs, turpentine was not very efficacious; and

as it caused grave symptoms of nephritis in pigs and caused the death of some of the experiment dogs, its use upon these animals is inadvisable.

The treatment with chopped tobacco stems recommended by Herms and Beach for ascarids in poultry proved fairly efficacious for *Heterakis papillosa* and would presumably be at least as efficacious for *A. perspicillum*, since this latter worm is more easily reached by anthelmintics than is *H. papillosa*.

There are a large number of drugs showing a greater or less degree of efficacy for the various intestinal parasites of domestic animals. Usually their action is selective—that is, they show a pronounced efficacy for certain species of intestinal worms, while they are decidedly less efficacious or entirely inefficacious against other intestinal parasites. If we consider the ideal anthelmintic one which will remove all worms of a given class or species, and do this every time in a single dose, we find that very few drugs approach this ideal.

Among the drugs which have given the best results under experimental conditions for the purposes intended and concerning which the writers have sufficient data to warrant positive conclusions may be mentioned the following: (1) Copper sulphate in drench for stomach worms in sheep; (2) oil of chenopodium for ascarids in pigs and dogs; (3) oleoresin of male fern for tape-worms in dogs; (4) turpentine for *A. perspicillum* in fowls; and (5) chopped tobacco stems for *H. papillosa* in fowls."

The treatment of severe burns with ambrine, C. G. McMULLEN (*Gen. Elect. Electr.* 20 (1918), No. 9, pp. 717-722, figs. 6; *Sci. Amer. Supp.* 85 (1918), No. 2203, pp. 190, 191).—This article describes the use of ambrine in severe burns and gives a résumé of the literature on the subject.

Bacteria in dust, E. BURNET (*Ann. Inst. Pasteur*, 31 (1917), No. 12, pp. 591-600).—In bacterial examinations of samples of fresh street dust, 3 out of 18 samples contained the tubercle bacillus. Dried dust obtained from vacuum cleaners in theaters, stores, etc., gave evidence at first of very few organisms, but with proper cultivation under anaerobic conditions it was found to contain, in addition to *Bacillus subtilis* and various representatives of the mesentericus group, putrefying organisms such as *B. welchii*, *B. tetanus*, and *B. sporogenes*.

The author suggests the possibility that certain cases of tetanus, the origin of which is obscure, may be caused by the tetanus spores penetrating into the body with very fine dust.

The action of cold on microorganisms, A. Q. RUATA (*Ann. Ig. [Rome]*, 28 (1918), No. 1, pp. 1-10).—The purpose of the studies reported was to determine whether microorganisms are actually destroyed by cold or whether they are simply rendered inert during the time in which they are kept at low temperature. Various organisms in gelatin culture were kept for from 1 to 24 days at a temperature of from -3 to -12° C. in a dry atmosphere. Each day a small portion of the gelatin culture was removed from the refrigerator and placed in an incubator at 22° for 10 days, at the end of which time the colonies in the various tests and in the control were counted. The biological properties of the organisms studied were tested in various ways. Studies were made on *Bacillus coli*, *B. pyocyaneus*, *B. proteus vulgaris*, *B. bulgaricus*, *B. clavatus*, and other putrefying organisms.

The results show that the prolonged action of cold produces not only a paralyzing effect upon microorganisms but progressively destroys them. The spores of *B. clavatus*, although more resistant than the bacillus itself, were gradually killed under prolonged action of cold. The bacteriological properties of the organisms studied showed progressive changes in accordance with the gradual destruction of the organism.

The author concludes that a practical application of the results obtained could be made in the preserving industry in the sterilization of various fresh foods.

The value of Wulff's method for the diagnosis of anthrax, L. SANI (*Clin. Vet. [Milan], Rass. Pol. Sanit. e Ig.*, 41 (1918), No. 1-2, pp. 4-10).—The diagnosis of anthrax with the aid of bone marrow as described by Wulff (*E. S. R.*, 27, p. 781) is considered by the author, after experimental work, to be preferable to all other methods, particularly where the diagnosis has to be made on carcasses which have undergone extensive putrefaction. The compactness and chemical composition of the bones are such as to offer greater resistance to putrefactive action and a favorable place for the development and preservation of the anthrax bacillus.

Studies on diphtheria toxin.—I, Hydrogen-ion concentration and toxicogenicity determinations with *Bacterium diphtheriae*, L. DAVIS (*Jour. Lab. and Clin. Med.*, 3 (1918), No. 6, pp. 358-367, figs. 2).—The purpose of the present investigation was to determine by means of the hydrogen electrode the reaction changes which take place in the medium during the formation of diphtheria toxin on a practical scale, and to note the relationship between toxicogenicity and hydrogen-ion concentration. The medium used for the study was plain bouillon made by adding 20 gm. of peptone and 5 gm. of sodium chloride to every liter of beef infusion prepared in the usual way. Adjustment to the desired hydrogen-ion concentration was made by the method of Clark and Lubs (*E. S. R.*, 37, p. 506). The experimental data led to the following conclusions:

"Toxin of maximum potency is produced in bouillon by *B. diphtheriae* only when the initial reaction falls within a certain zone of alkalinity, included within the hydrogen-ion concentration limits of about 7×10^{-8} to about 5×10^{-7} . Luxuriant growth of the organism appears to be possible where the reaction of the bouillon ranges from about $C_H^+ = 1 \times 10^{-8}$ to about $C_H^+ = 8.4 \times 10^{-8}$. When cultivated in plain bouillon under optimal conditions, *B. diphtheriae* undergoes an initial increase in hydrogen-ion concentration. This is soon followed by a steady decrease until apparently a limiting alkaline reaction is attained. The total acid produced is relatively small and seems to vary in amount with each individual strain. Toxicogenic strains appeared to develop more acid than an avirulent strain. The initial increase in hydrogen ions is due to fermentation of some constituent in both peptone and beef infusion. No direct relationship can be found between the hydrogen-ion concentration of the medium and toxicity during the growth of *B. diphtheriae*."

The intrapalpebral mallein reaction, A. LANFRANCHI (*Mod. Zootro, Parte Sci.*, 28 (1917), No. 9, pp. 197-202, fig. 1; *abs. in Rev. Gén. Méd. Vét.*, 27 (1918), No. 314, p. 86).—The author states that in cases where the intrapalpebral mallein reaction, previously noted (*E. S. R.*, 32, p. 374), produces either through successive injections or other causes sclerosis of the connective tissue, the injection of mallein may be made in the upper instead of the lower eyelid. In case of a negative reaction at least 15 days should elapse before repeating the injection.

The intrapalpebral reaction in the diagnosis of epizootic lymphangitis, A. LANFRANCHI (*Mod. Zootro, Parte Sci.*, 28 (1917), No. 10, pp. 217-225, fig. 5; *abs. in Rev. Gén. Méd. Vét.*, 27 (1918), No. 314, pp. 80, 81).—The intrapalpebral reaction employed in the diagnosis of glanders, previously noted (*E. S. R.*, 32, p. 374), has been successfully applied for the diagnosis of epizootic lymphangitis. The material for the test, taken aseptically from mature lesions rich in cryptococci, is attenuated by shaking in ether for about 24 hours, evaporating the ether, and heating the mixture for from 15 to 20 min.

mes in a water bath at 80° C. It is then centrifuged for 20 to 30 minutes, and the clear liquid is ready for injection in doses of from 2.5 to 3 cc., according to the technique employed for the mallein reaction.

Pyotherapy in epizootic lymphangitis. A. LANFRANCHI and P. BANDELLI (*Med. Zoologia, Parte Sci.*, 28 (1917), No. 12, pp. 261-275, figs. 3).—The author reviews the literature on the treatment of epizootic lymphangitis by pyotherapy and reports unsuccessful results of using this method in cases of light, moderately severe, and severe lesions. He concludes that pyotherapy or autopyotherapy does not represent a method for the definite cure of epizootic lymphangitis.

A study of hemorrhagic septicemia: Observations in sheep and in mouflon-sheep hybrids. N. MORI (*R. Ist. Incoragg. Napoli, Ann. Staz. Sper. Malattie Infell. Bestiame*, 3 (1916), No. 2, pp. 3-35; *abs. in Internat. Inst. Agr. [Rome], Internat. Rev. Sci. and Pract. Agr.*, 8 (1917), No. 7, pp. 1010-1012; *Abstr. Bact.*, 1 (1917), No. 6, p. 529).—A short history of the disease as reported by various investigators is given followed by a detailed study of it as observed in material from the Naples Veterinary School and other districts of southern Italy. The symptoms and anatomical lesions in subacute and chronic forms of the disease are described.

The organism *Bacillus orisepeticus*, responsible for the disease, is polymorphous, Gram-negative, nonmotile, nonspore-forming, and aerobic. Immune serum prepared with it agglutinates the strains of hemorrhagic septicemia of other animal species, thus justifying the interpretation that the various strains are races of a single organism derived through acclimatization in organisms of another species. For the treatment of the disease the author refers to the serum vaccine treatment of Rachiger (*E. S. R.*, 35, p. 77) and others.

A bibliography of 14 titles is appended.

The enzymes of the tubercle bacillus. H. J. CORVER and H. C. SWEANY (*Jour. Bact.*, 3 (1918), No. 2, pp. 129-151, figs. 3).—Studies on the autolysis of tubercle bacilli, previously noted (*E. S. R.*, 36, p. 181), were continued by the determination of autolysis of bovine tubercle bacilli and a determination of the α -amino nitrogen in the autolysate. It was found that "tubercle bacilli of both the human and bovine varieties possess autolytic enzymes, as indicated by the non-coagulable nitrogen and α -amino acid nitrogen liberated at incubator temperature after the bacilli have been killed by toluene and chloroform."

The presence of individual enzymes in the tubercle bacillus was determined by the nephelometric method of Kober and Graves (*E. S. R.*, 32, p. 310) and by examining the autolysate for the various products of enzyme action. It was found that "the bacilli themselves, or autolysates therefrom, also possess a trypsin-like enzyme capable of splitting proteins in alkaline solution, an erepsin-like enzyme capable of decomposing peptone in acid solution, a weak pepsin-like enzyme capable of splitting proteins in acid solution, a nuclease capable of splitting nucleic acid, and a urease capable of decomposing urea."

"The tubercle bacilli, or autolysates therefrom, do not possess enzymes capable of hydrolyzing starch or inverting sucrose, demonstrable by the delicate Lewis and Benedict picramic acid method. Autolysates from tubercle bacilli do not possess enzymes capable of digesting elastic tissue prepared from lamb lung, or connective tissue prepared from tubercles, at least as indicated by the methods used for demonstrating these enzymes."

Bovine tuberculosis: Its diagnosis and control. V. A. MOORE (*Amer. Jour. Vet. Med.*, 13 (1918), No. 4, pp. 167-172).—This article gives a historical survey of bovine tuberculosis and the measures taken in different countries for its control, a description of the nature and distribution of the lesions of the disease,

and a discussion of the tuberculin reaction. An inquiry into the cases where tuberculin has failed to produce a reaction on tuberculous animals has shown that the failure may be attributed to one or more of the following causes: (1) The use of strains of tubercle bacilli which do not make an efficient tuberculin, (2) the use of cultures of the bacilli which are not properly grown and do not contain a sufficient quantity of the specific protein to enable it to cause a reaction, (3) the interpretation of the manifestations following the use of tuberculin not made in accordance with the laws governing the reaction between it and the products of tuberculous lesions in the living animals, (4) the application of tuberculin in the period of incubation, (5) the tuberculous lesions being arrested, healed, encapsulated, or very extensive, and (6) repeated administrations of tuberculin resulting in the failure of the reaction after one or more injections. In the opinion of the author subcutaneous injection has been more satisfactory than other methods of administering tuberculin.

The biological behavior of *Piroplasma bigeminum* in cows in Eritrea.—The variety acquired in the practice of serum vaccination against rinderpest, G. DI DOMIZIO (*Mod. Zootatro, Parte Sci.*, 28 (1917), Nos. 10, pp. 232-236, fig. 1; 11, pp. 247-259).—*P. bigeminum* in Eritrea is so widespread that practically all cows are afflicted with it at some period of their lives. As a latent infection it may not be detected by itself either clinically or microscopically, but it is very easily detected in connection with rinderpest. An animal whose resistance is weakened by rinderpest is more susceptible to *P. bigeminum*, which is often present in the blood used for inoculation against rinderpest. For this reason the author recommends that in serum vaccination against rinderpest in Eritrea great care should be taken regarding the purity of the serum in order to have it as free as possible from the *Piroplasma*. This can best be accomplished by taking the serum on the fourth or fifth day of the disease at which time the symptoms of rinderpest alone are present, the circulating blood containing active rinderpest virus but with no *Piroplasma* or in such small quantities that it can not be detected in microscopic examination. The serum should not be taken on the sixth or seventh day of the illness, because the virulence of the virus is more attenuated and because the *P. bigeminum* is probably present in greater numbers and in a more virulent form.

A bacteriological report in regard to hog cholera, G. F. GARDENHI (*Chia. Vet. [Milan], Rass. Pol. Sanit. e Ig.*, 41 (1918), No. 4, pp. 84-88).—A typical case of hog cholera is reported with post-mortem findings and a bacteriological study of the filterable virus obtained from the animal.

The results led to the conclusion that the Voldagsen strain of paratyphoid B can be found associated with filterable virus in hog cholera.

Fundamental principles governing the control of hog cholera, D. F. LUCKET (*Amer. Jour. Vet. Med.*, 13 (1918), No. 4, pp. 157-160, 200).—The principles discussed are more thorough and efficient organization, attention to the sources of infection, more stringent quarantine regulations, and laws forbidding the sale of hogs affected with any disease and prohibiting vaccination except by graduate veterinarians.

Statistics on the use of hog cholera antiserum and hog cholera virus, C. G. COLE (*Amer. Jour. Vet. Med.*, 13 (1918), No. 4, pp. 173, 174).—During the year 1917, 16.7 per cent of all the hogs in Iowa were immunized. The average percentage of losses from the use of the simultaneous method in healthy herds over a period of five years was 2.1, the loss in 1917 being only 0.7 per cent. A report on 264,367 hogs, consisting of 92,943 sick or exposed and 171,424 healthy hogs, shows a loss of 2.1 per cent of healthy and 15.5 per cent of sick hogs. Of the hogs actually sick when treated, a recovery of 34.1 per cent is shown by the use of the serum-alone method against 29 per cent by the use of the

simultaneous method. The serum-alone treatment thus seems to be more successful in the case of sick hogs, although the simultaneous method is superior from the standpoint of immunizing hogs.

Ulcerous lymphangitis in horses (*Clin. Vet. [Milan], Rass. Pol. Sanit. e Ig. II* (1918), No. 1-2, pp. 11-19, pl. 1).—In this article are summarized the clinical forms and symptoms of ulcerous lymphangitis caused by the Preisz-Yocard bacillus, the evolution and differential diagnosis of the disease, and its prophylactic and therapeutic treatment.

Infections caused by *Bacterium pullorum* in adult fowls, P. [R]. HADLEY et al. (*Rhode Island Sta. Bul.* 172 (1917), pp. 3-40).—This bulletin reports the results of a study in which it was established that *Bacterium pullorum* was the causative agent in an epidemic in adult fowls indistinguishable in its clinical picture and pathological manifestations from fowl typhoid.

The primary observations and the experimental features of the study lead to the conclusion that latent *B. pullorum* infection was stimulated into active manifestations of fatal generalized infection as a result of intestinal irritation, or other physiological changes, following the feeding of a ration containing a large proportion of roughage in the form of oat husks. The author points to the need of regarding more seriously the endogenous as opposed to the exogenous origin of 'epidemic' diseases among poultry. Among possible endogenous disease-stimuli the importance of a hygienic feeding regime is especially emphasized.

The existence of intermediate bacterial forms, resembling *B. pullorum*, but varying slightly toward *B. gallinarum* Klein is suggested, and it is proposed to make use of the terms *B. pullorum* A and *B. pullorum* B in order to keep these types distinct pending their further study. It is further suggested that *B. pullorum* appears to stand as a border line group in the colon-typhoid intermediates, separating the actual paratyphoids (*B. gallinarum*, etc.) from the actual paracolons (*B. suispestifer*, *B. paratyphosus* A and B, etc.). It is recommended that, in order to facilitate bringing about some degree of order in the group of 'colon-typhoid intermediates,' gas-forming strains be referred to the paracolon group, which should be revived; and that anaerogenic forms only should be referred to the paratyphoid group, in which *B. gallinarum* might stand as the type species."

The author reports that he has data on three epidemics in adult stock due to the agency of *B. pullorum*. These epidemics, two of which were somewhat extensive, occurred in widely separated parts of the country. In all three bacteria of the fowl typhoid type (*B. gallinarum*) were absent, yet the clinical picture and the pathological manifestations were those of fowl typhoid.

A list of 13 references to the literature is given.

A study of the etiology of roup in birds, J. G. JACKLEY (*Kansas Sta. Tech. Bul.* 4 (1917), pp. 5-23).—A summary of inquiries pertaining to poultry diseases at the station gave the following approximate percentage relationship of the various poultry diseases in Kansas: Roup 70 per cent, cholera 15 per cent, white diarrhea 9 per cent, blackhead 1 per cent, and other troubles, including mites, lice, worms, etc., 5 per cent. Losses to the industry from roup vary with different seasons, occasional outbreaks showing a mortality of from 50 to 100 per cent, while in other years only 5 per cent of the flock may be infected with perhaps less than 1 to 2 per cent mortality. Cases that recover from roup are relieved to be unprofitable, egg production generally being completely suspended for a time, and the bird seldom fattens and may die later.

In the course of the investigations here reported small Gram-negative, diplococcus-like rods, which did not form spores nor form gas in carbohydrates,

were isolated and apparently deserve recognition as the etiological factor in roup. This organism was recognized in smears from all cases of diphtheria and ocular roup examined. It was grown upon artificial media and the disease again reproduced, and a high degree of protection was shown against the natural disease after immunization with pure cultures. A bibliography is appended.

A further study of the etiology of roup in fowls, J. G. JACKLEY (*Jour. Amer. Vet. Med. Assoc.*, 52 (1918), No. 7, pp. 853-858, fig. 1).—Additional results obtained in the work above noted further support the claim that a bacterium of the Pasteurella group isolated by the author is the etiological factor in roup.

RURAL ENGINEERING.

Surface water supply of North Atlantic slope basins, 1916 (*U. S. Geol. Survey, Water-Supply Paper 431* (1918), pp. 176+XXXVI, pls. 2).—This report, prepared in cooperation with the States of Maine, Vermont, Massachusetts, and New York, presents the results of measurements of flow made on the St. John, Machias, Union, Penobscot, Kennebec, Androscoggin, Presumpscot, Saco, Merrimac, Blackstone, Connecticut Housatonic, Hudson, Delaware, Susquehanna, Patuxent, Potomac, and Rappahannock River Basins during 1916. Lists of the stream-gauging stations and the publications of the Geological Survey relating to water resources for this region are appended.

Surface water supply of the lower Mississippi River Basin, 1916 (*U. S. Geol. Survey, Water-Supply Paper 437* (1918), pp. 50+XXXII, pls. 2).—This report presents the results of measurements of flow made on the Arkansas and Red River Basins during 1916. A section on stream-gauging stations and publications relating to water resources is appended.

Surface water supply of Hawaii, 1916 (*U. S. Geol. Survey, Water-Supply Paper 445* (1917), pp. 224).—This report, prepared in cooperation with the Territory of Hawaii, presents the results of measurements of flow made on certain streams and ditches and rainfall records of the islands of Kauai, Oahu, Maui, and Hawaii for 1916.

Southern California floods of January, 1916, H. D. McGLASHAN and F. C. EBERT (*U. S. Geol. Survey, Water-Supply Paper 426* (1918), pp. 80, pls. 16, map 1).—This report, prepared in cooperation with the State of California, presents precipitation records, describes the flood of January, 1916, and reports measurements of flood run-off in the various river basins within the flood area.

Rapid chemical determination of the potability of water, COMTE (*Chim. Pharm. et Chim.*, 7. ser., 14 (1916), No. 5, pp. 135-140; *abs. in Chem. Abstr.* (1917), No. 7, p. 857).—It was found that, as a result of the examination of more than 250 samples of water in the Argonne region of France, in impure waters the amounts of nitrites in the same specimen may double in 24 hours at laboratory temperature while pure waters show no such variation. The maximum action is reached in 48 hours. Two nitrite determinations are made, one at once and the other on the same sample after 24 hours. By this method even a very slight microbic action may be detected.

"The waters of the Argonne region are graded as follows: Good waters—NaCl, below 12 mg. per liter; NH_4 , below 0.05 mg.; oxygen consumption, below 1.2 mg.; nitrites calculated as KNO_3 , below 0.03 mg. If there is no variation after 24 hours. Suspected waters—NaCl, 12 to 20 mg.; NH_4 , 0.05 to 0.1 mg.; oxygen consumption, 1.2 to 2.5 mg.; nitrites, 0.03 to 0.1 mg.; if the amount varies in the same sample within 24 hours, the limits are 0 to 0.03 mg. Bad waters contain—NaCl, above 20 mg. per liter; NH_4 , above 0.1 mg.; oxygen consumption, above 2.5 mg.; nitrites, above 0.1 mg.; if there is appreciable vari-

done in the same sample in 24 hours, 0.03 mg. of nitrites will be the lower limit for bad water."

The cracking and buckling of cement concrete pavements, H. T. TUTTILL (*Good Roads, n. ser., 14 (1917), No. 20, pp. 255, 256, figs. 4*).—Data on three concrete roads paved with 1:1.5:3 concrete and provided with transverse expansion joints 30 ft. apart are reported. The joint used consisted of a $\frac{1}{2}$ -in. strip of creosoted yellow pine and the shoulders in all cases were of a sandy loam.

It was found that "In the case of the pavement built with the coarse aggregate of imported crushed stone, there has been no buckling or heaving of the slabs. The pavement developed cracks, but the number of them as compared with the number in the gravel concrete was less, as was also the width of the cracks. No buckling occurred in the pavement built with the deep ditch section, in which the coarse aggregate was gravel. There were numerous cracks, however, running in every direction, those occurring longitudinally of the pavement opening very wide. On the shallow ditch section of the gravel concrete pavement, bad cases of buckling, considerable distances apart, occurred within a week during an extremely hot spell. Longitudinal cracks were also more or less frequent on this section, but there were few diagonal cracks."

Tests show advantages of laying brick directly on concrete base, C. C. KILBY (*Engin. News-Rec., 79 (1917), No. 18, pp. 820-822, figs. 5*).—Tests at the University of Illinois are reported on 66 slabs, including plain concrete slabs intended to represent ordinary concrete roads and monolithic brick slabs (1) consisting of grouted brick only, (2) with a thin layer of mortar used to smooth the surface of the concrete, and (3) with the bricks laid directly on the green concrete. Wire-cut-lug bricks were used in virtually all slabs.

"Comparison of the results given in the accompanying tabulation will show that when the concrete side of the slab is in tension the direction of the brick courses has little effect on the strength, and that the modulus of rupture is approximately that of plain concrete of the same quality. This is true when the concrete forms roughly one-half of the thickness of the slab. With the very thin bases, the brick makes up a sufficient part of the total slab to govern its behavior.

"When the bricks are in tension there is a marked difference in strength with the direction of the courses of brick, as would be expected. Here the slabs with longitudinal courses show high strength, in most instances greater than that of 1:2:3 concrete. This is doubtless due to the fact that the bricks lay in such a way that a shearing stress is set up between the bricks and the grout, and the bond in this direction is sufficient to develop high beam strength. The slabs with transverse joints are very much weaker since in this case the stress is direct tension on the bond between the brick and the grout. The beams with diagonal courses show a strength intermediate between these two....

"Little difference in strength is noted between the 'dry-layer' type and the 'direct-contact' type of construction, and what difference exists is probably due to a difference in the grout. The 'dry-layer' slabs used a grout of $\frac{1}{4}$ -in. sand, which a few tensile tests showed to yield a stronger grout than the $\frac{1}{2}$ -in. sand used in the 'direct-contact' specimens. The grout of $\frac{1}{4}$ -in. sand was decidedly more difficult to mix properly and showed more tendency to segregate than did the other—a point worth considering in actual construction. In the 'dry-layer' type of construction the bricks show the greater tendency to separate from the concrete. The materials in a dry mix are never associated as intimately as those in a wet mix, and consequently the cement does not come

into as thorough contact with either the sand grains or the brick. The 'mortar layer' is, therefore, weaker than the underlying concrete, and the bond to the brick is not great. . . .

"The monolithic type of construction combines the strength of the brick slab with that of the concrete base in such a manner as to develop the maximum in both, and these tests show that such a compound slab is fully equal in strength to a concrete road slab of the same thickness. It appears, therefore, that in the monolithic brick road the brick and the concrete should not be considered as separate units of a pavement, but rather as integral parts of a single structure. . . . With this type of construction it seems, therefore, entirely logical to reduce the total thickness of the slab, either by reducing the thickness of the base or by using thinner bricks, provided a sufficient gross thickness is retained to furnish strength enough to carry the probable loads, and this necessary gross thickness can be determined on the same basis as the thickness of a concrete road."

Tests on nailed joints in fir and hemlock timbers, H. F. BLOOD and H. E. PLUMMER (*Abstr. in Engin. News-Rec.*, 79 (1917), No. 19, pp. 871, 872, figs. 1; *West. Engin.*, 8 (1917), No. 12, pp. 478-483, figs. 8).—Tests on the strength of nailed joints, using Douglas fir and western hemlock, are reported, which covered 110 joints, 87 with Douglas fir and 23 with western hemlock. All tests were designed to show the strength of nailed joints with wire nails used in single shear.

Safe values for nails driven in perpendicularly to the grain in either wood, with the load perpendicular to the length of the nail, were established as follows: 10 and 12-penny nails, 120 lbs. load value per nail; 16-penny nail, 100 lbs.; 20-penny nail, 200 lbs.; 30-penny nail, 270 lbs.; 40-penny nail, 320 lbs.; 50-penny nail, 400 lbs.; 60-penny nail, 480 lbs.

"For nails driven parallel with the grain of the wood the figures above should be reduced 25 per cent. All of these values should be reduced if the penetration of the nail in the holding piece is less than 50 per cent of its length.

"Other conclusions in the report are that the resistance of nails driven perpendicularly in the timber with the grain of the wood parallel to the load is but little more than for nails driven similarly with the grain of the wood perpendicular to the load. It is also indicated that the standard nail heads are of proper proportions, there being no difficulty with the nail head pulling through the outside timber. The strength of the joint seems to be affected but little by the penetration of the nail in the centerpiece if that penetration is 50 per cent or more of the length of the nail, but with less penetration the loads were reduced, and for a penetration of 30 per cent the strength reduction amounted to about 25 per cent. The examination showed that each nail in a joint seemed to support an equal proportion of the load. . . .

"The resistance of the nailed joint, if depending solely on the resistance of the wood to crushing, varies with the diameter of the nail, other things being unchanged. On the other hand the resistance of the joint, if depending solely on the resistance of the nail to bending, varies as the cube of the diameter of the nail. As the resistance of the joint depends on the combination of these two, various sized nails give varying degrees of resistance, but it is found that the variation of the resistance corresponds quite closely with the square of the diameter of the nail."

Relative resistance of various hardwoods to injection with creosote. C. R. TEESDALE and J. D. MACLEAN (*U. S. Dept. Agr. Bul.* 606 (1918), pp. 36, pls. 12, figs. 16).—Creosote penetration tests similar to those previously reported for coniferous woods (*E. S. R.*, 31, p. 743) are here reported for some of the

more important hardwood species native to this country. The experiments were made at the Forest Products Laboratory maintained by the Forest Service in cooperation with the University of Wisconsin.

The subject matter is discussed under the following general headings: Structure of the hardwoods, methods used in the experiments, apparatus, materials used, method of applying the creosote, factors affecting penetration, effect of structure on penetrance, grouping of species, relation of grouping to commercial treatment, and conclusions. Notes on the characteristics of the various species, together with the results of the tests and a bibliography of related literature are appended.

The farm machinery situation, E. A. WHITE (*Illinois Sta. Circ.* 210 (1918), pp. 4).—The need under present conditions of careful overhauling of farm machinery and early ordering of new machinery and repairs is emphasized.

Gas engine nomenclature (*Gas Engine*, 19 (1917), No. 10, pp. 504-513).—This is the report of the nomenclature division of the data committee of the National Gas Engine Association.

[Magnetos for farm engines], C. V. HULL (*Power Farming*, 26 (1917), Nos. 7, pp. 25, 32, 34, figs. 9; 8, pp. 24, 34, 35, figs. 8; 9, pp. 35, 36, 40, figs. 9; 10, pp. 42, 43, 45, figs. 7; 11, pp. 16, 36, 37, figs. 6).—This is a series of five articles on magnetos for farm engines.

The relations of port area to the power of gas engines and its influence on regulation, J. R. DU PRIEST (*Gas Engine*, 19 (1917), Nos. 7, pp. 357-364; 8, pp. 397-399, figs. 14).—Experiments are reported the object of which was to present a method of determining the port area required for any fractional load on a throttling gas engine operating on the four-stroke cycle and to suggest a means of so admitting the fuel as to get the same degree of speed regulation throughout the full range of load.

From a consideration of data obtained in tests of a horizontal double-acting tandem throttling engine, operating on natural gas, and the characteristic curve of the governor used, a method was devised by means of which the relation between the travel of the governor collar and port area for a given power can be determined. This is expressed mathematically and by tabular data.

A new fuel for internal-combustion engines (*Brit. Patent* 1719 (1916), *Week. Engin.*, 39 (1917), pp. 313, 314; *abs. in Sci. Abs., Sect. B-Elect. Engin.*, 10 (1917), No. 235, p. 220).—A British method for starting and running internal-combustion engines is described in which the fuel can be prepared in a plastic state from ingredients independent of oil fields. One composition consists of 41 parts potassium nitrate, 41 parts charcoal, and 18 parts sulphur with moisture to make it plastic. The most important feature is the method for obtaining partial combustion to provide a residue of energy after the first stage, to be used in a second cylinder by the addition of air or oxygen. The second combustion stage may be further subdivided. The products of partial combustion are mainly carbon monoxid, methane, and hydrogen, diluted with nitrogen and carbon dioxid. An example of the use of this fuel is in the starting of an engine for which large air compressors would be necessary. By igniting a cartridge of solid fuel an independent reservoir can be immediately charged with gas at high pressure and used for the engine.

How to lay out and put up a lineshaft, R. H. SMITH (*Power Farming*, 26 (1917), No. 11, pp. 9, 41, fig. 1).—The details of this process are here given.

The use of rope on the farm, V. OVERHOLT (*Agr. Col. Ext. Bul. [Ohio State Univ.]*, 12 (1916-17), No. 5, pp. 48, figs. 137).—This bulletin is published for the instruction of farmers and students and deals with rope materials and construction; kinds, weight, and strength of rope; coiling and uncoiling of rope;

whipping rope ends; rope splicing; rope halters and halter ties; knots, bends and hitches; and blocks and tackle. Tabulated data on weights and safe and breaking loads of ropes are included.

Movable hog houses, J. D. McVEAN and R. E. HUTTON (*U. S. Dept. Agr. Office Sec. Circ. 102 (1918), pp. 8, figs. 7*).—The advantages of colony or movable houses are discussed, and instructions, illustrations, and bills of materials for building the box-shaped and A-shaped houses are given.

RURAL ECONOMICS.

Factors of successful farming near Monett, Mo., W. J. SPILLMAN (*U. S. Dept. Agr. Bul. 633 (1918), pp. 28*).—This is a report of a study of 274 farms which have been divided into the following types: Grain and live stock, grain only, grain and fruit, fruit only. The following table gives data showing variations found for these four types:

Effect of type of the farm upon investment, size, and income.

Type of farm.	Number.	Total investment.	Average number acres.	Labor income
Grain and live stock.....	116	\$11,015	95	\$28
Grain.....	66	7,396	78	17
Grain and fruit.....	41	7,594	68	46
Fruit.....	17	4,919	36	24

The author discusses the organization of farms by types, as well as the profitableness of the various types, the proper status of the strawberry industry in southwest Missouri, the speculative nature of fruit enterprises, maintenance of soil fertility, organization of some typical farms, use of legumes, and tenure.

The determination of the cost of production of farm live stock and dairy produce, J. WYLLIE (*Scot. Jour. Agr., 1 (1918), No. 1, pp. 15-29*).—The author discusses the various factors to be considered in the cost of producing farm live stock and dairy produce. Among his conclusions are that home-grown feeds should be charged to the stock according to their farm market value; also that special consideration should be given to the valuation of manure from the stock in obtaining the net cost. He outlines various methods that may be used in valuing the manure.

The cost of production of milk, G. A. FERGUSON (*Scot. Jour. Agr., 1 (1918), No. 1, pp. 29-33*).—The author outlines a system of bookkeeping designed to obtain the cost of milk, together with the different items that must be maintained in order to obtain accurate accounts. He considers that there should be a record book to be kept by the man in charge of the cow, together with a cash book to be kept by the accountant. He discusses the methods that are to be used in arriving at a fair price for the feeds raised on the farms, the value of the farm manure, and of the live stock at the beginning and the end of the year.

A study of farm labor in California, R. L. ADAMS and T. R. KELLY (*California Sta. Circ. 193 (1918), pp. 75*).—This report discusses the farm labor shortage in 1917 and the probable situation in 1918. It gives details with reference to wages, living conditions, and sources of labor. The principal part of the report consists of excerpts from reports made to the investigators by various persons in regard to the labor problem.

Cooperative organization by-laws, C. E. BASSETT and O. P. JEANES (*U. S. Dept. Agr. Bul. 541 (1918), pp. 23*).—The authors give suggestions in regard to methods of organization, especially to those desiring to meet the requirements of the amendment to the Sherman antitrust law commonly known as the Clayton amendment. They discuss methods of dealing with nonmembers, differences between nonstock and stock forms of organization, financing and perpetuating nonstock organizations, and the relation of this amendment to existing organizations, and have also suggested forms of by-laws for a cooperative nonprofit marketing association formed without capital stock.

Cooperative stores in Minnesota, 1914, E. D. DURAND and F. ROMOTKA (*Minnesota Sta. Bul. 171 (1917), pp. 31, figs. 4*).—Among the conclusions brought out in this publication are that the number of cooperative stores in Minnesota is about 125, changing very little. About two-thirds of the companies reporting paid dividends. For all stores adequately reported, the average gross sales were \$45,836 for 1914, the ratio of expense to gross sales 11.7 per cent, and the ratio of net gain to gross sales, 4.5 per cent. If the success of cooperative stores be measured by the ratio of net profit to gross sales, the factor showing the greatest influence is the ratio of total operating expense to gross sales. The rapidity of turn-over of stock greatly influences success. The size of business has considerable influence upon success, although some successful stores are found in groups of all sizes. In a business of a given size the most efficient management is secured by the managers with the higher salaries.

Modern market methods, A. L. CLARK (*N. J. Dept. Agr. Bul. 7 (1917), pp. 215-246, pls. 12*).—This bulletin calls attention to the different methods of marketing agricultural products in New Jersey, and points out the factors necessary in any system to be successful. Among these factors are the standardization of grades, packs, and packages, cooperative selling organizations, State regulation of the commission business, municipal promotion of retail marketing, and thrift and more accurate information on the part of housewives.

The mill market for corn and wheat, W. R. CAMP (*North Carolina Sta., Farmers' Market Bul., 5 (1918), No. 20, pp. 10*).—This bulletin contains the usual data with reference to products which the farmers have for sale, together with information regarding the number of mills in the State grinding corn and wheat.

Regulations of the Secretary of Agriculture under the United States Warehouse Act of August 11, 1916.—Regulations for cotton warehouses (*U. S. Dept. Agr., Office Sec. Circ. 94 (1918), pp. 43*).—Regulations promulgated January 4, 1918, are presented. The text of the legislation (*U. S. R., 35, p. 309*), is appended.

Parcel-post business methods, C. C. HAWBAKER and J. W. LAW (*U. S. Dept. Agr., Farmers' Bul. 922, pp. 20, figs. 4*).—This gives detailed suggestions regarding means of obtaining customers and methods of carrying on business, with samples of suitable bills, letterheads, order blanks, and other business forms. It points out that parcel-post shipments are increasing in number, though probably they always will affect only a small percentage of the farm produce going to market. It is concluded that dealings by parcel post should be successful if the farmers are careful to keep up the quality of their produce, pack it safely and attractively, and meet engagements promptly, and the consumer likewise observes business methods in the transaction.

Geography of the world's agriculture, V. C. FINCH and O. E. BAKER (*U. S. Dept. Agr., Office Sec., 1917, pp. 149, pls. 2, figs. 206*).—The purpose of this study is to show the geographic origin of the world's supply of food and of other important agricultural products, and to indicate briefly the climatic, soil,

and economic conditions that account for the distribution of the crops and live stock of the world. The volume contains a series of maps showing, by means of the dot system, the acreage and production of practically all types of agricultural crops and live stock, not only for the United States but for foreign countries, together with brief descriptive accounts as to the principal areas of production. There are also maps showing altitude and precipitation for all countries of the world. An introductory article on The Food Supply of the United States is included, in which it is concluded "that the United States is dependent on the outside world for very few articles of fundamental importance and that the majority of these are supplied by countries in the Western Hemisphere."

Agricultural production for 1918, with special reference to spring planting and to live stock (*U. S. Dept. Agr., Office Sec. Circ. 103* (1918), pp. 22).—This report contains the Department recommendations with reference to acreage of spring plantings and number of live stock that are deemed necessary in order to feed our own population and to make up the deficit in the food supply of the allies as previously noted (*E. S. R.*, 38, p. 101.)

Prospects of French agriculture, L. MANGIN (*Rev. Sci. Paris*, 55 (1917), No. 18, pp. 545-553).—The author discussed the crop situation in France in 1916 as compared with previous years, together with the situation in other countries. In conclusion he advises, in order to meet the present prices, that bread be made containing from 10 to 12 per cent rice flour; that the colonial and other laborers in France be regulated and organized for agricultural purposes; that additional tractors be manufactured and used; that the price of wheat be increased to stimulate production; and that some means be found for increasing the supply of artificial fertilizer. He also suggests that better methods of distribution are needed in certain communities.

Reorganization of agriculture in France, E. COQUINÉ (*Ann. Sci. Agron.*, 4 ser., 5 (1916), Nos. 7-9, pp. 393-419; 10-12, pp. 497-543).—This report deals primarily with the lands which have been devastated by the war. It discusses the methods of reconstruction of the farm buildings, and the necessary agricultural machinery, and also takes up the question of introducing new methods of cultivation and of selling crops and of using waste lands. Attention is given to the questions of social hygiene, eugenics, and the influence of the extensive use of alcohol upon the rural people.

The food of France, D. BELLET (*Paris: Librairie Félix Alcan*, 1917, [4]+, pp. 249+[7]).—In this report are discussed the food requirements and sources, giving details with reference to meat, fish, cereals, poultry, milk, butter, fruit and sugar.

Agricultural statistics of Uruguay (*Estadist. Agr. [Uruguay]*, 1916, p. IV+164+CCCXLI).—This issue continues information previously noted (*E. S. R.*, 36, p. 690), by adding data for a later year.

AGRICULTURAL EDUCATION.

Teaching the value of the fundamental sciences to students in animal husbandry, E. S. SAVAGE and L. A. MAYNARD (*Amer. Soc. Anim. Prod. Proc.* 1916, pp. 174-177).—In this article a plea is made for greater attention to the teaching of the fundamental sciences in training prospective teachers and investigators in animal husbandry.

The value of the fundamental sciences in teaching and in investigation in animal husbandry, E. S. SAVAGE (*Amer. Soc. Anim. Prod. Proc.* 1915, pp. 77-81).—An outline of a suggested 4-year course, with the approximate time to be devoted to each subject, is presented and discussed, indicating the author's

conception of the character and amount of the fundamental sciences necessary in teaching the science and art of animal husbandry and leadership in life.

The curriculum, W. C. COFFEY (*Amer. Soc. Anim. Prod. Proc.* 1915, pp. 82-83).—In this paper the author contends that the so-called practical subjects should be retained in the animal husbandry curriculum, but not permitted to dominate it.

Coordination of courses in animal husbandry, C. S. PLUMB (*Amer. Soc. Anim. Prod. Proc.* 1915, pp. 70-76).—The author briefly reviews the history of the introduction of animal husbandry courses into the agricultural colleges of this country and discusses the present status of these courses in 14 agricultural colleges in the Central West. He urges that the colleges, in order to strengthen and advance the pedagogical significance of animal husbandry instruction, adopt uniform titles for the same or closely related subjects, cover much the same ground work in all courses having like titles, so arrange the courses as to pass in logical sequence wherever possible from freshman to senior years, clearly define and establish prerequisites when necessary in connection with all courses, and adopt uniformity in credit hours so as to enable the exchange of credits between institutions of comparable rank.

Conventionalism in the teaching of live-stock judging, E. B. FORBES (*Amer. Soc. Anim. Prod. Proc.* 1916, pp. 178-185).—The author submits detailed observations in substantiation of his contention that the present teaching of live-stock judging is not of the highest grade of educational value, because of its lack of scientific basis and of its large measure of conventionalism, and suggests possible methods of improvement in the instruction.

Teaching breed history to advanced students, H. W. MCMFORD (*Amer. Soc. Anim. Prod. Proc.* 1916, pp. 252-259).—An outline, used in teaching Durco Jersey history to a class of graduate and advanced undergraduate students, is offered as suggestive of the subject matter of a course in teaching breed history to a rather small group of advanced students specializing in animal husbandry. Helpful equipment and practicums are also suggested.

Home course in soils and soil management, compiled by C. F. PENNEWELL (Alameda, Cal.: Compiler, 1917, Books 1, pp. 12; 2, pp. 8; 3, pp. 12; 4, pp. 10; 5, pp. 12; Answers, pp. 14).—This home course in soils for the rancher consists of a series of five booklets which deal respectively with (1) the origin, formation, and composition of soils, and soil and plant growth; (2) physical properties of the soil; (3) water supply of the soil, and soil temperature and drainage; (4) nitrogen, inoculation, nitrification, green manuring, and crop rotations; and (5) the phosphorus and potassium of soils, and acidity and liming. Answers to the question in each book are added in a separate pamphlet.

Courses in agriculture on the home-project basis (*Ind. Bd. Ed., Bd. Bul.* 27 (1917), pp. 395, fig. 1).—This bulletin contains (1) outlines, subject matter, and references to literature for carrying out home projects in swine production, baby-beef production, sheep raising, colt raising, dairy-cow management, dairy-calf raising, poultry raising, egg production, home gardening (also market and truck gardening and gardening and canning), fruit growing, landscape gardening, potato growing, bee-keeping, and corn production; and (2) outlines of courses in soils and farm crops, respectively, prepared by M. L. Fisher, for the seventh and eighth grades and high school and vocational grades (18 weeks). Directions are given to seventh and eighth grade, high school, and vocational teachers with reference to the amount of work to cover in one year, the selection of projects, and the method of instruction.

Subject matter for 1917-18 in natural history, agriculture, and home making, based on the New York State syllabus for elementary schools (*Cornell Rural School Leaflet*, 11 (1917), No. 1, pp. 322, figs. 255).—This leaflet

is intended as a book of reference and suggestions for teachers, indicating to them what may be learned about a given topic and ways in which boys and girls may be led to gain the knowledge by first-class observation and experience.

Part 1 contains extracts from letters from rural and urban teachers, stating their attitude toward and success in nature-study work; articles by a number of scientific writers on such topics as the Migration of Birds, Keeping Dairy Herd Records, Handling Milk, Biting and Sucking Insects, and Potato Growing; and descriptions of various birds, insects, common farm crops, weeds, trees, etc. Suggestions for using the technical knowledge are contained to some extent in the articles themselves but more largely in editorial notes introducing the various sections.

Part 2, Home Making, consists of a special article on hand sewing, by Julia Gleason, including a few examples of the application of various processes.

Part 3 is devoted to notes and suggestions on the teaching of nature study, physical training, children's gardens, the improvement of school grounds, observations on corn day, a general exhibition for farmers' week in February, 1918, Junior home project work, etc. A brief list of reference books on nature study and elementary agriculture, home making, plant life, animal life, etc., is included.

Rural science, including school gardening, R. N. SHERIDAN (*Dept. Agr. and Tech. Instr. Ireland Jour.*, 17 (1917), No. 2, pp. 260-263).—After briefly defining the school garden, the author discusses its evolution and development in Ireland.

A primer of household biology, E. W. GUDGER (*Bul. N. C. State Norm. and Indus. Col.*, 7 (1917), No. 1, pp. 103, figs. 25).—In this bulletin it is the purpose of the author to give students a sound scientific conception of some of the fundamental principles of biology and a practical knowledge of certain important living things. The plan, which is the outcome of 12 years' teaching of household biology to freshmen students in the State Normal College of North Carolina, began as a course strictly in preparation for domestic science, but has widened its scope to include some of the fundamentals of hygiene and sanitation and of the maintenance of soil fertility. It includes studies of a green alga, an animalcule, yeasts, bacteria, molds, and the cycles of matter. A statement is made at the beginning of each chapter as to where and how the material needed can be obtained.

The States Relations Service and the cooperative extension service, A. C. TRUE (*Gen. Fed. (Women's Clubs) Mag.*, 17 (1918), No. 1, pp. 19-21, fig. 1).—The work of the States Relations Service of particular interest to women is discussed. This includes home economics club work and extension activities.

MISCELLANEOUS.

Report on experiment stations and extension work in the United States, 1916 (*U. S. Dept. Agr., Rpt. Agr. Expt. Stas. and Coop. Agr. Ext. Work U. S.*, 1916, pp. 334+496, pls. 13).—This report, prepared by the States Relations Service for the fiscal year ended June 30, 1916, consists of two parts.

Part I. Work and expenditures of the agricultural experiment stations, 1916.—This part includes the usual report on the work and expenditures of the agricultural experiment stations in the United States, including Alaska, Hawaii, Porto Rico, and Guam, together with detailed statistics compiled from official sources as to the organization, revenues, additions to equipment, and expenditures of the stations.

The total income of the experiment stations, including the insular stations during the fiscal year ended June 30, 1916, was \$5,334,073.90. Of this amount

\$720,000 was derived under the Hatch Act, \$719,000.75 under the Adams Act, \$119,978.34 from Federal appropriations for the insular stations, \$2,903,824.19 from State appropriations, \$17,686.18 from individuals and communities, \$335,280.84 from fees, \$515,791.47 from the sale of products, and \$901,523.96 from miscellaneous sources. The value of additions to the equipment of the stations was estimated at \$1,018,976.06, of which \$490,345.97 was for buildings.

The stations employed 1,866 persons in the work of administration and inquiry. Of this number 933 were also members of the teaching staff of the colleges and 561 assisted in farmers' institute and other extension work. During the year the stations published 1,733 annual reports, bulletins, and circulars, aggregating 25,923 pages, and these were distributed to 1,147,300 addresses on the regular mailing list.

Part II. Cooperative extension work in agriculture and home economics, 1916.—This part comprises a report on the receipts, expenditures, and results of cooperative extension work in agriculture and home economics in the United States. Of this, pages 17-150 are devoted to Extension Work in the South, pages 151-371 to Extension Work in the North and West, pages 373-375 to Farmers' Institutes in the United States in 1916, by J. M. Stedman, and pages 376-400 to statistics of farmers' institute and extension work.

Thirtieth Annual Report of Alabama College Station, 1917 (Alabama Col. Sta. Rpt. 1917, pp. 28).—This contains the organization list, a financial statement for the Federal funds for the fiscal year ended June 30, 1917, and reports of the director and heads of departments on the work of the station during the year. The experimental work reported is for the most part abstracted elsewhere in this issue.

Annual report of the director of the experiment station on work done under the local experiment law in 1917, J. F. DUGGAR (Alabama Col. Sta. Circ. 38 (1918), pp. 7-52).—This includes a report by the director on the progress of the work under this law (E. S. R., 24, p. 400), a financial statement for the year, and reports from heads of departments, including detailed reports of boys' and girls' club work and other extension activities. Experimental work in pig feeding is abstracted on page — of this issue.

Report of Hawaii Station, 1917 (Hawaii Sta. Rpt. 1917, pp. 56, pls. 8, fig. 1).—This contains the organization list, a summary by the agronomist in charge as to the work of the year, and reports of the divisions of horticulture, chemistry, plant pathology, agronomy, extension, and Territorial marketing, and of the Glenwood substation. The experimental work recorded is for the most part abstracted elsewhere in this issue.

Monthly Bulletin of the Ohio Experiment Station (Mo. Bul. Ohio Sta., 3 (1918), No. 2, pp. 31-64, figs. 19).—This number contains an article entitled Sorghum As a Substitute for Sugar, several other articles abstracted elsewhere in this issue, and miscellaneous notes.

Farm knowledge, edited by E. L. D. SEYMOUR (*Garden City and New York: Doubleday, Page & Co., 1918, vols. 1, pp. XVI+552, pl. 1, figs. 72f; 2, pp. XVI+558, pl. 1, figs. 677; 3, pp. XVI+488, pl. 1, figs. 715; 4, pp. XVI+552, pl. 1 figs. 439*).—This is a farmer's cyclopedia, consisting of a large number of special articles, many of which are by agricultural college, experiment station, and U. S. Department of Agriculture officials. Volume 1 deals with farm animals, volume 2 with soils and crops, volume 3 with farm machinery, and volume 4 with farm management.

NOTES.

Delaware College and Station.—The horticultural department is undergoing reorganization. C. A. McCue will retain general direction of all its activities but has been relieved of other station work. It is expected that a research horticulturist will be appointed. R. R. Pailthorp, assistant horticulturist, has resigned to accept a position with the Bureau of Markets of the U. S. Department of Agriculture, with headquarters at Spokane, Wash.

M. L. Nichols, assistant professor of agronomy, has resigned to accept a position at the Virginia College in charge of extension work in farm engineering and has been succeeded by F. M. Rast, Jr., assistant professor of soils and fertilizers in the University of Florida. C. E. Neff, assistant agronomist in the station, has resigned to enter military service and has been succeeded by Geoffrey Houghland. Dr. R. D. Mullinix, of the University of Chicago, has been appointed assistant chemist in the station beginning July 1.

Kentucky Station.—S. L. Hibberd, of the department of agronomy, and J. C. Field, field agent in cooperative purchasing and marketing, have resigned. W. H. Simmons, dairy inspector, has been transferred to veterinary work in cooperation with the Bureau of Animal Industry of the U. S. Department of Agriculture.

Louisiana Stations.—The legislature has appropriated \$82,000 for the purchase of a college farm. A tract has been selected about three miles from the college grounds which comprises approximately 600 acres of alluvial lands and 500 acres of highlands, or bluff, soil. Practically the entire area is now in cultivation. Plans for the equipment and operation of the farm have not yet been completed, but the property will be taken over by the college of agriculture January 1, 1919, and used for instructional work.

Minnesota University and Station.—The resignations are announced of W. L. Oswald as assistant professor of botany, effective April 18; Ben C. Helmick as assistant professor of agronomy, effective April 1, to become instructor in agronomy and associate agronomist in the Connecticut College and Storrs Station; William Dietrich as assistant professor of animal husbandry and animal husbandman at Crookston, effective May 1, to become county agent at Preston; David O. Spriesterback as research assistant in agricultural biochemistry, effective April 1; and Carl Kurtzwell as assistant in cereal crops, effective April 1. I. D. Charlton, professor of farm engineering, has been placed in charge of the work in army mechanics being given at the training school now in progress at the university farm.

Nevada Station.—Owing to heavy losses where lambs are produced on the open range, a study of methods of increasing the percentage of lambs in Nevada flocks has been planned. Where lambs are produced under sheds, the percentages are as high as from 120 to 130 per cent, while on the range it seldom runs above 85 per cent.

Porto Rico Federal Station.—William P. Snyder, assistant in plant breeding, has been commissioned second lieutenant in the National Army. T. B. McClelland has been promoted to horticulturist and Leonard A. Dalton has been appointed assistant horticulturist.

Rhode Island Station.—Marguerite W. Elkins, assistant in animal breeding and pathology, has resigned.

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